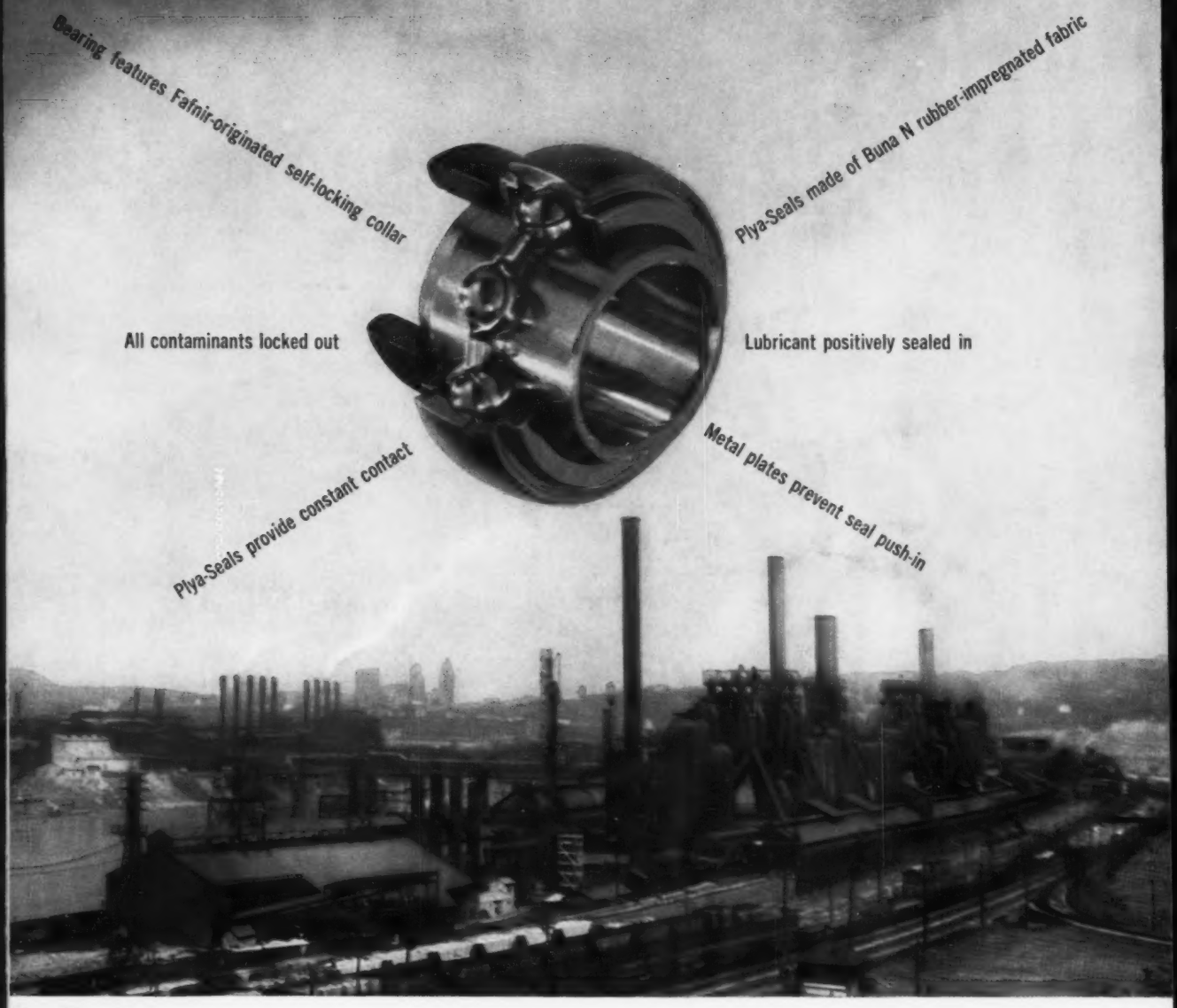
APRIL 1958 – SIXTY-FOURTH YEAR

Machinery


Bearing features Fafnir-originated self-locking collar
Plya-Seals made of Buna N rubber-impregnated fabric
All contaminants locked out
Lubricant positively sealed in
Plya-Seals provide constant contact
Metal plates prevent seal push-in

Built-in Life Preservers . . . Fafnir contact type Plya-Seals are now available in the famous Fafnir-originated Wide Inner Ring Ball Bearing with Self-Locking Collar. These seals ensure trouble-free performance in slow-to-moderate speed applications where bearings are exposed to excessive dirt, moisture, or other contaminants. The bearing, identified as the R R SERIES, is also obtainable in a wide variety of Fafnir power transmission units.

FAFNIR
BALL BEARINGS

The Most Complete Line in America
The Fafnir Bearing Company, New Britain, Conn.

it's mainly a matter of TIMING!

WHEN to replace a machine can mean the difference between profit and loss

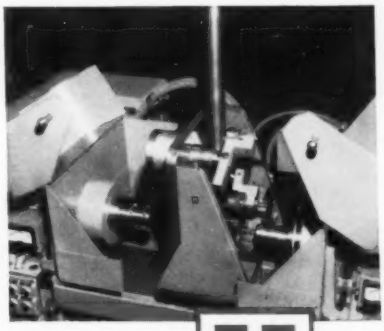
TOO EARLY is just as bad as too late. But somewhere in between there's a mathematically determinable *right time* to retire that old machine and replace it with a new one. A time when this replacement works out to your best advantage from the standpoint of production cost and capital investment.

Guess-work, intuition or rule-of-thumb computations usually come up with the wrong answer. And even carefully conceived "obsolesence formulas" may have their pitfalls. Because incorrect replacement timing, one way or the other, can *waste* thousands of dollars, this problem is of vital concern to all industry.

But Heald can help you solve it. Our sales engineers are well experienced in precise methods of replacement analysis. If you're in doubt, or would like to check your own computations, call in your Heald engineer. He will be glad to help you determine the right time to replace. And if now is too soon, he will tell you so. Similar cost studies by Heald engineers have pointed the way to many substantial savings.

For example: This new Heald Model 322 Bore-Matic replaced a heavy-duty drill for boring and chamfering hydraulic-cylinder piston rods. A cost analysis determined that the investment in a new machine could not be deferred any longer without serious financial loss. As verified by subsequent operation, the new machine offered the following savings:

	Old Machine	New Machine
Parts per hour	11	24
Machine load, per year	3,080 hrs.	1,380 hrs.
Direct & Indirect Labor	9,480 hrs.	3,240 hrs.
Annual Maintenance	$356	$100
Annual Operating Cost	$27,800	$15,000
Annual Saving, New Machine	----------	$12,800
Net Return on Investment	----------	39.6%



YOU pay for obsolesence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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BPA NBP

Machinery

APRIL 1958 **VOL. 64 NO. 8**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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LANROLL attachment

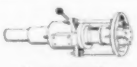
exclusive features

The LANROLL Attachments offer certain features of design that ensure greater accuracy, flexibility and economy not generally found in Thread Rolling Tools. The LANROLL Attachment (capable of producing straight or taper threads) is primarily for application to bar automatics, but may be applied very successfully to the cross slide of a lathe with power feed. Five sizes of the Attachment thread all diameters from #5 to 1¾" (1/16" to 1¼" pipe). For additional detailed information, please request Bulletin G-96.

These THREADING TOOLS displayed at Booth 1538 ASTE Show

Threading Machines

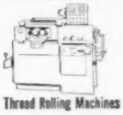
Die Heads—Rotary & Stationary



Taps—Collapsible & Solid Adjustable

Centerless Thread Grinding Machines

Thread Rolling Tools



Thread Rolling Machines

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

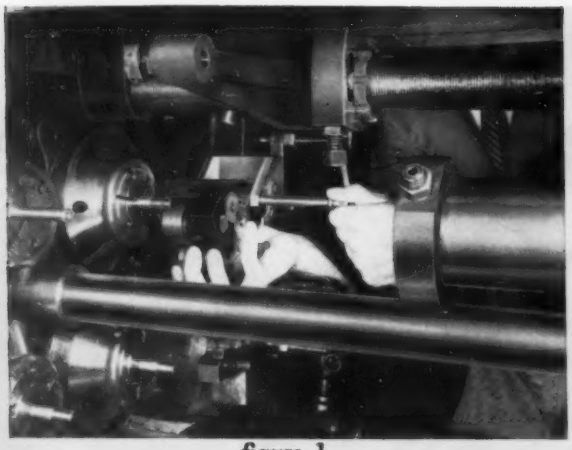


figure 1

1. Disengaging the attachment from the shank for servicing and tooling changes without disturbing the original set-up is made possible by the simplicity of design. The shank maintains attachment set-up position and remains clamped on the tool slide. Removal of the attachment from the shank simply requires that a single retaining screw be released and the shank pin withdrawn. (Figures 1 & 2).

2. Tipping avoids indexing interference on bar automatics having a limited tool slide movement. When necessary, the basic design permits the attachment to radially pivot away from the rolling area on completion of the thread (Figure 2). This also permits: an attachment of heavier construction, minimizing deflections and assuring exact sizing; larger roll diameters for greater rolling efficiency; and more rugged spindles.

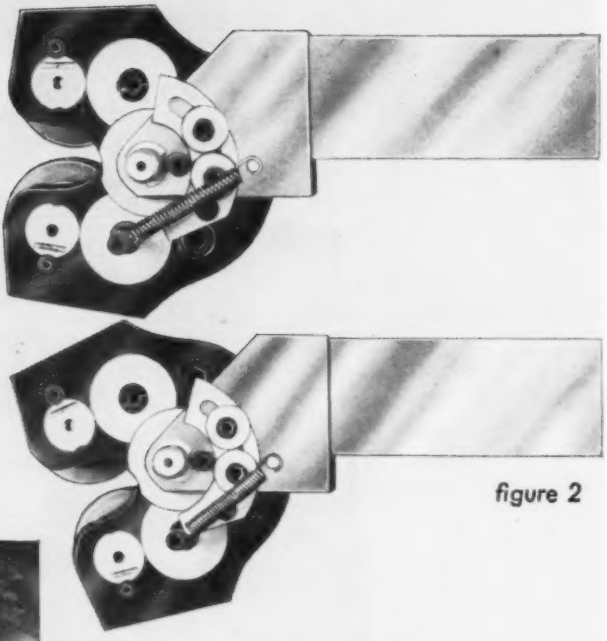
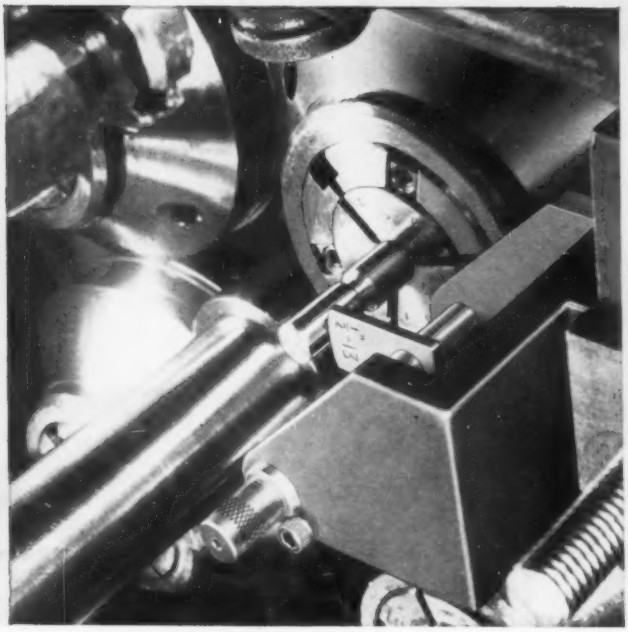


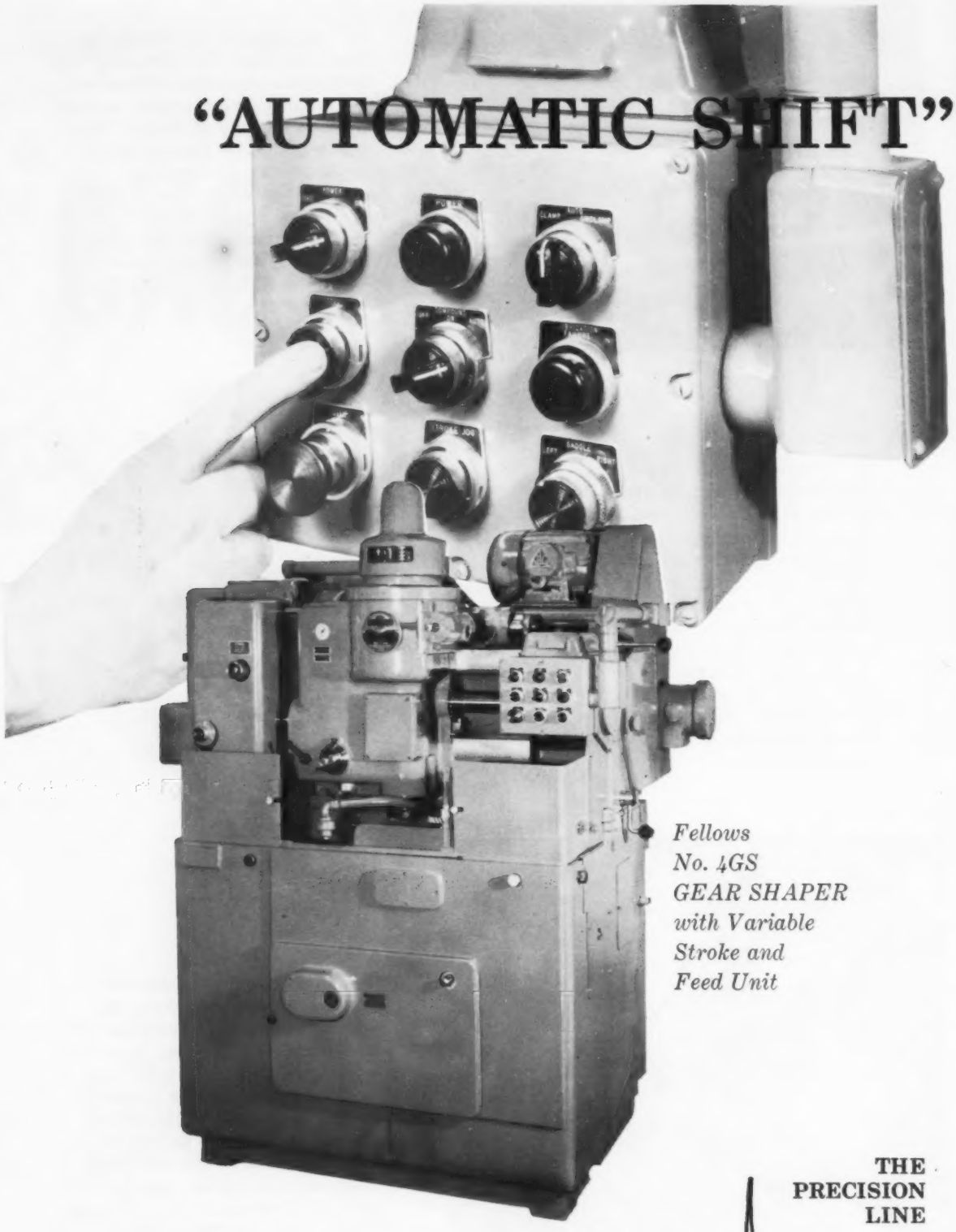
figure 2



3. A Gage quickly determines the precise position where the vertical centerlines of both the rolls and workpiece coincide. After the attachment has been positioned horizontally in relation to the prepared workblank, the setting gage is slipped over the shank pin. The high point of the machine's feed cam is established, and the tool slide is advanced until the gage abutts with the O.D. of the workblank (Figure 3).

figure 3

"AUTOMATIC SHIFT"



Fellows
No. 4GS
GEAR SHAPER
with Variable
Stroke and
Feed Unit

THE
PRECISION
LINE

changes Stroke and Feed

✓ Cuts production time...
✓ Lowers overall costs

Now... you can lower overall costs by using the Fellows No. 4GS Gear Shaper with the new, optional Variable Stroke and Feed Unit which *automatically* changes the rate of stroke and rotary feed between first and second cuts at any selected ratio within the speed and feed ranges of the machine.

With the Variable Stroke and Feed Unit the No. 4GS can make two cuts, and give you two-cut quality, in approximately the same time required for a single cut. There is no need to compromise on cutting speeds or feeds. Roughing and finishing cuts can be made at rates which are optimum for cutter and material.

Cutter wear is minimized, and finish is improved, because you can select and use the best combination of strokes per minute and feed per stroke of the cutter for each cut. Once the selector switches and gear ratios have been set, changes in speed and feed occur automatically during the cutting cycle.

The Variable Stroke and Feed Unit is available as an optional unit on all Fellows No. 4GS Gear Shapers. The selector switches for this unit can be set to operate the machine as a standard Gear Shaper; to change *either* the strokes per minute *or* the rotary feed for the finish cut; or, to change *both* stroke and feed for the finish cut.

The No. 4GS provides nine cutter speeds ranging from 98 to 635 strokes per minute and rotary feeds ranging from 0.008" to 0.028" per stroke, based on a 4-inch pitch diameter cutter. Set-ups are easy and fast for internal or external, spur or helical gears, as well as cams, splines and other non-involute shapes up to 6" pitch diameter and 2" face width.

For full information, get in touch with your nearest Fellows representative. If you would like to have a 72-page booklet describing the Fellows No. 4GS Gear Shaper and its operation, just write to any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
5835 West North Ave., Chicago 39, Illinois
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

ARBOR-LOC®

CINCINNATI'S NEWEST FEATURE

ARBOR-LOC is a big timesaver in interchanging the seven cutting tools on the table of the CINCINNATI Dial Type Milling Machine illustrated here.

CINCINNATI®

MILLING MACHINES • BROACHING MACHINES • CUTTER
METAL FORMING MACHINES • HARDENING MACHINES •

Reduces Setup Time

Standard Cincinnati Arbors interchanged *in seconds!*

Saving time and money in multiple operation milling is simple with the new ARBOR-LOC formula: multiply a minute or more x tool changes x pieces per lot. ARBOR-LOC is a new cost-reducing feature incorporated in *most CINCINNATI knee-and-column milling machines. It gives the operator an opportunity to quickly and safely change cutters and arbors as often as required. Just picture these ARBOR-LOC advantages for your own shop:

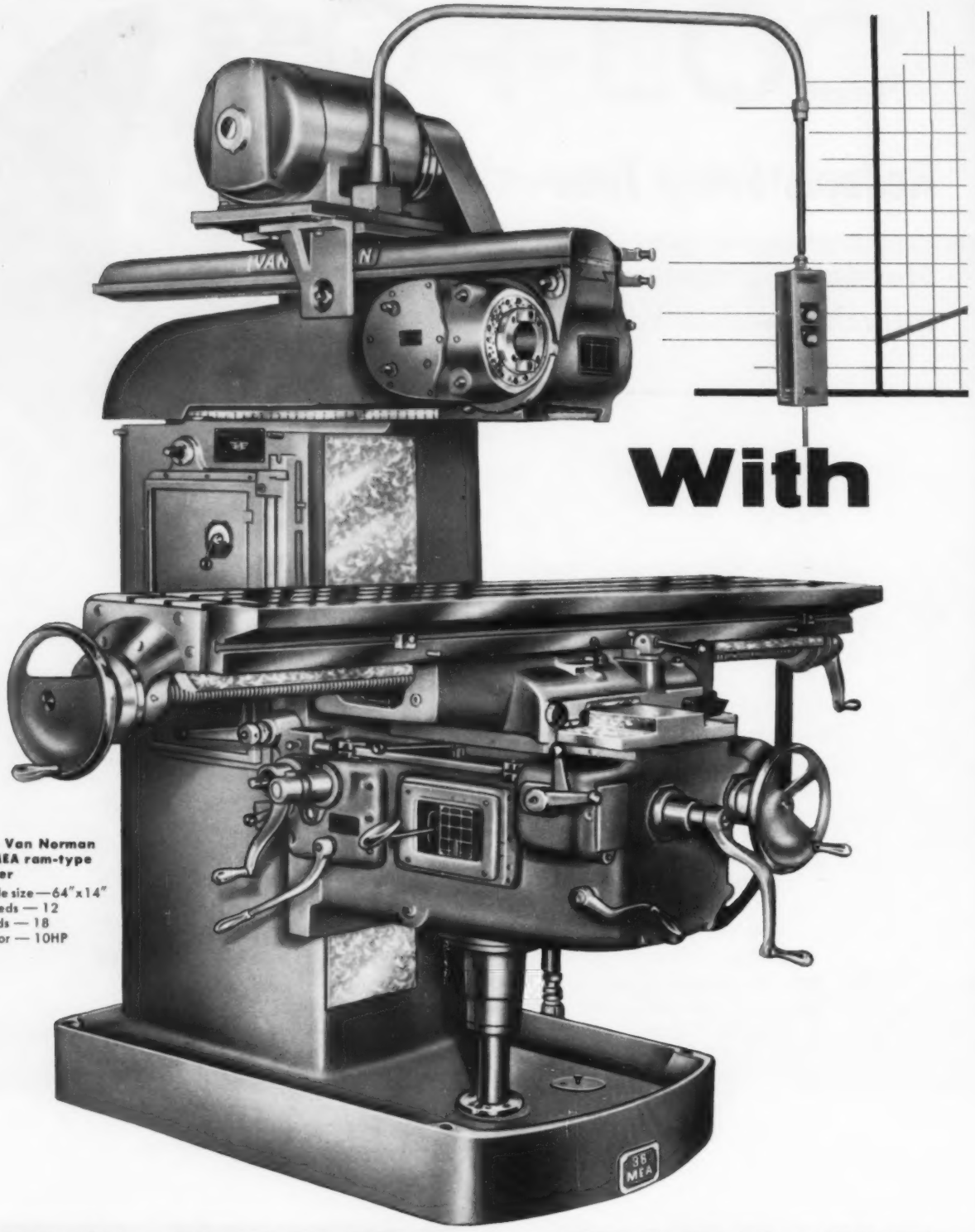
- **Increases productivity of the machine for short runs. Arbors can be changed in a few seconds' time.**
- **No need for special-purpose quick-change accessories for multiple operations. ARBOR-LOC accommodates Cincinnati's complete new line of standard No. 50 flanged arbors and adapters.**
- **Simplifies tooling problems through more complete standardization of arbors and similar accessories.**
- **Quickly assembled and removed for setups where not required, such as for face milling cutters.**
- **Does not restrict use of existing arbors, adapters, etc.**

CINCINNATI

*The following CINCINNATI knee-and-column milling machines are equipped with ARBOR-LOC spindle nose: Nos. 2ML; 2 and 3MI; 2, 3 and 4 Dial Type; 2 and 3 High Power Dial Type; 2 and 3 Dual Power Dial Type; plain, universal and vertical styles. You may obtain more information by writing for publication No. M-2016.

AND TOOL GRINDERS • SPECIAL MACHINE TOOLS
CUTTING FLUIDS • GRINDING WHEELS

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



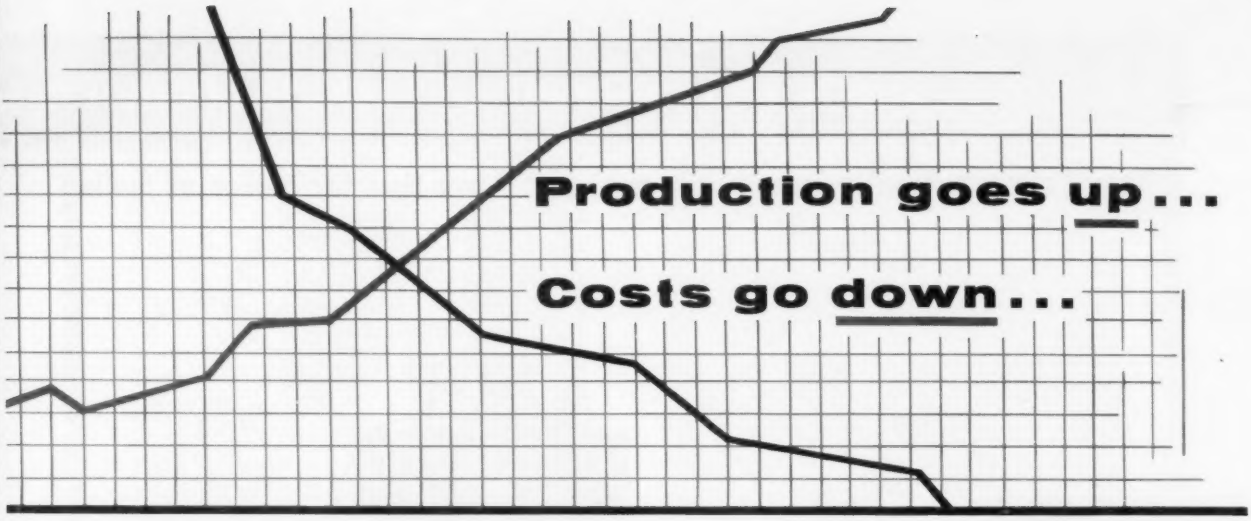
With

The Van Norman 38MEA ram-type miller
Table size—64"x14"
Speeds — 12
Feeds — 18
Motor — 10HP

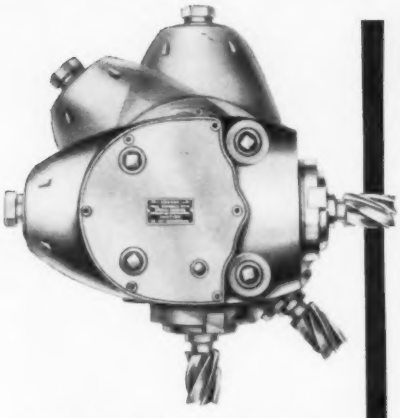
VAN NORMAN MACHINE

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



Van Norman Dollar-Saving Millers



The exclusive Van Norman adjustable cutterhead which can be easily set for horizontal, vertical or angular milling. Remember, with Van Norman millers, the cutterhead moves — not the work.

You get the equivalent of two conventional millers, plus attachments, when you make *one* investment in *one* Van Norman ram-type miller. That's because the exclusive Van Norman adjustable cutterhead lets you do horizontal, vertical and angular milling — all on one Van Norman machine.

You save important investment dollars and important production dollars thru reduced setup time, idle machine and operation time — plus boosting production.

Get complete details on the Van Norman 38MEA — and all Van Norman dollar-saving millers. Write, wire or phone for detailed catalog.

COMPANY

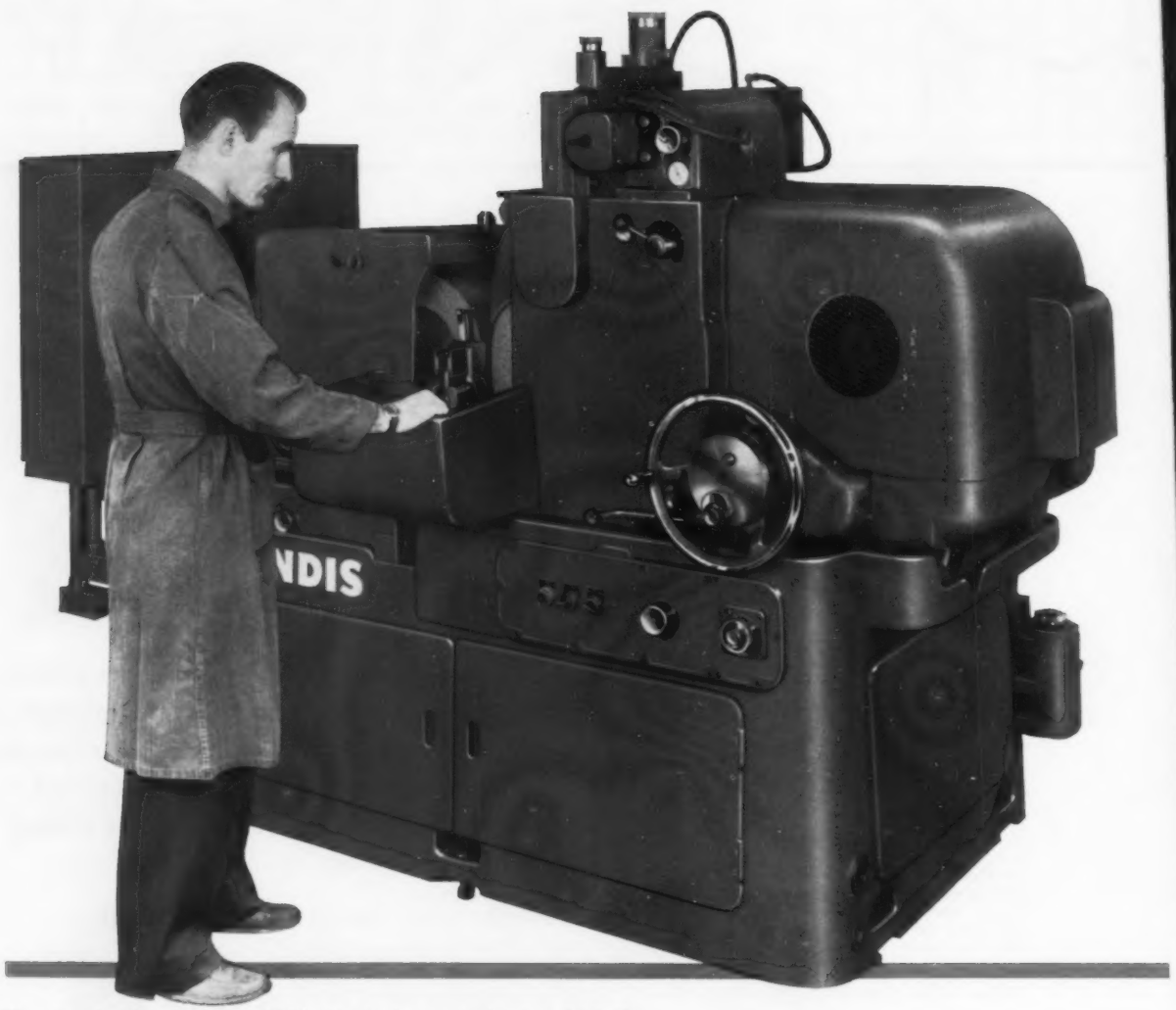
SPRINGFIELD 7, MASSACHUSETTS

Don't wait . . . for extra profit install a Van Norman machine now!
They are available in many purchase plans . . . Outright sale . . .
Purchase on conditional sales contract up to five years . . .
Pay as you depreciate up to 10 years.
Conditional Sales Contracts not available to Export.

For more information fill in page number on Inquiry Card, on page 195

Centerless grinds two different crankshaft diameters

different size crankshafts ground with minimum down time for change of tooling

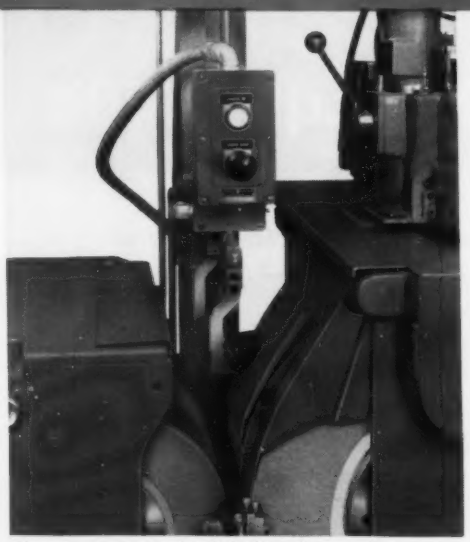


The standard Landis No. 12½ Centerless grinder to which the tooling shown here was added to lower grinding costs.

LANDIS

precision grinders

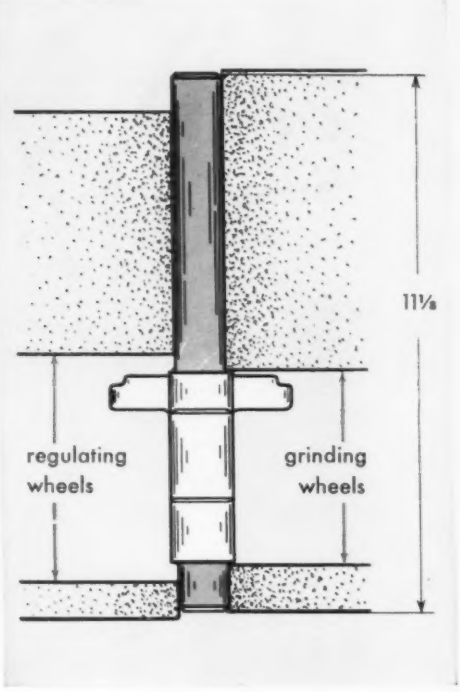
at one time with push-button cycling



Operator puts shaft in loader and presses loader "down" button to move workpiece into grinding position.

Automatic grinding wheel feed begins when workpiece is in grinding position. Grinds to finish size and resets.

Two different length shafts are ground on this machine with vertical type loader to clear counterbalance of crankshaft.

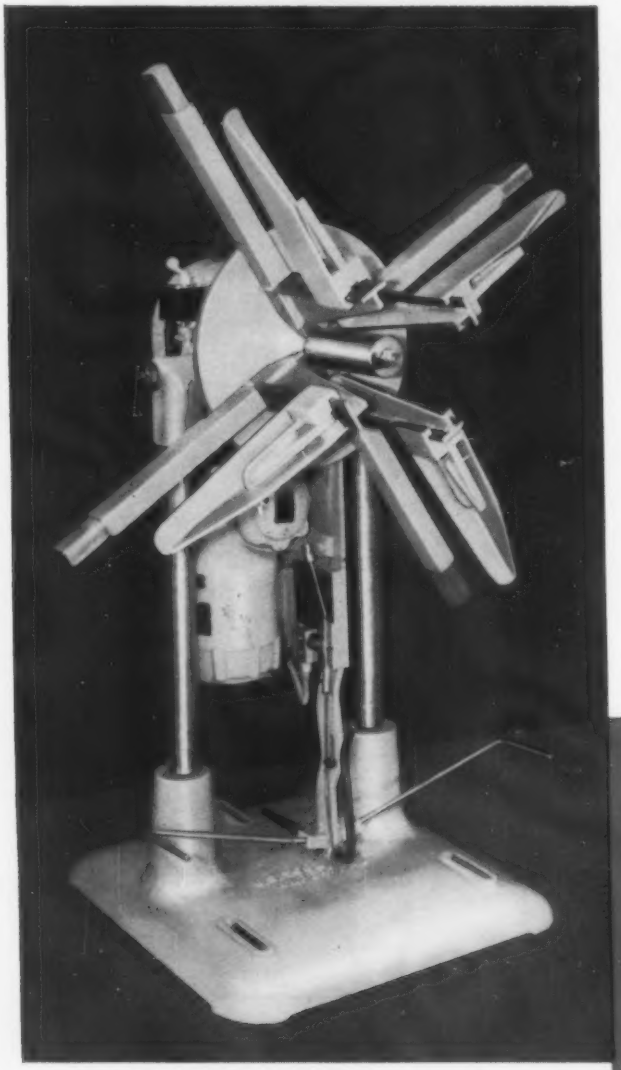


production data

Machine:	No. 12½ Centerless
Production:	180 shafts per hour each operation
Stock Removal:	.012" from each diameter, rough grind .002" from each diameter, finish grind
Tolerances	
Diameters:	.0003"
Concentricity:	.0002" T.I.R.
Roundness:	.0001" T.I.R.
Taper:	.0001" per inch
Finish:	16 micro-inch or better

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

U S PRODUCTS — For the Newest in Press Room Equipment

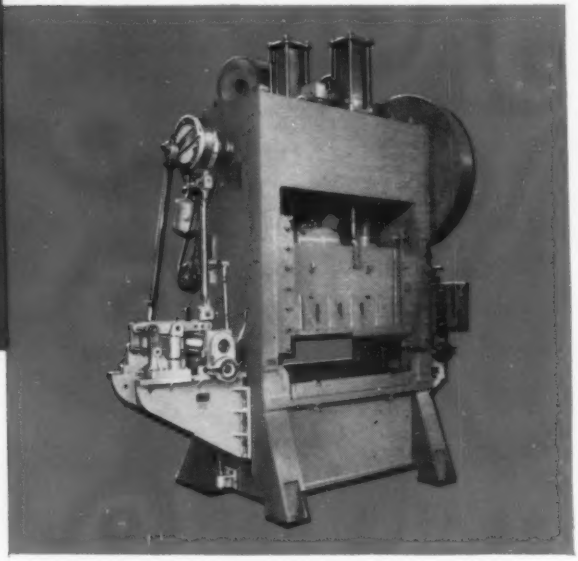


ACR-1040 Motor-Driven Centralizing Stock Reel

The U. S. Model ACR-1040 Motor-Driven Centralizing Stock Reel is brand new. It features a Centralizing Mechanism operated by the motor to expand and contract the cross members supporting the I.D. of the coil. This completely mechanical operation allows the Model ACR-1040 to handle reels with I.D. from 10" to 20" and widths up to 10". The maximum O.D. is 40" at 16" core diameter. Operation is smooth and quiet. Model ACR-1040 is equipped with Loop Control Mechanism and 1/3 HP motor for operation on 220/440 volts, 3 phase, 60 cycle A. C. Weight capacity is 600 pounds.

The Model RF-12-12 Style "B" U. S. Rack and Pinion Roll Feed is suitable for material up to 12" in width by up to 3/16" thick. Feeding length is adjustable up to a maximum of 12".

U. S. Style "B" Roll Feeds are made in both double and single types, with bolster plate for O.B.I. presses or with adjustable mounting brackets for Straight Side Presses. All are equipped with hardened and ground rolls of hollow construction which are driven by hardened spiral gears running in oil. These gears are mounted in an enclosed housing. The roll-pin type overrunning clutch has carbide inserts. Standard equipment also includes manual roll lifters; self-equalizing brakes; two-piece adjustable driving eccentric to simplify timing the feed in relation to the motion of the ram of the press; stock oiler and eccentric operated scrap chopper. Automatic roll lifters are available in either ram operated or adjustable eccentric operated types.



RF-12-12 Style "B" Double Roll Feed

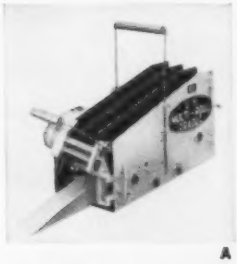
Visit the U S PRODUCTS Booth 1554 at the A.S.T.E. Tool Show

We will exhibit, for the first time, 3 new additions to our line. These are:

1 A completely redesigned U. S. Slide Feed — Model SF-68. This is suitable for material up to 6" in width. Feeding length is adjustable up to 8" at one stroke. In addition to features such as durability, versatility and accurate feed length for which U. S. Slide Feeds are recognized, this new model has a more positive check mechanism and will be quicker and easier to adjust.

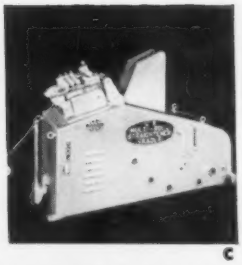
2 The Model RF-12-12 Style "B" U. S. Rack and Pinion Roll Feed displayed is suitable for material up to 12" in width by up to 3/16" thick and with feeding length adjustable up to a maximum of 12".

3 The Model ACR-1040 U. S. Motor-Driven Centralizing Stock Reel which uses the motor to mechanically expand and contract the cross members supporting the I.D. of the coil.



A

B



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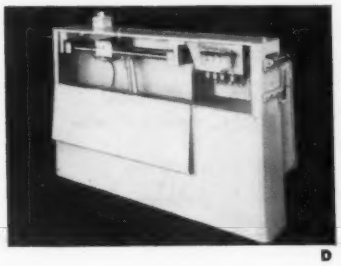

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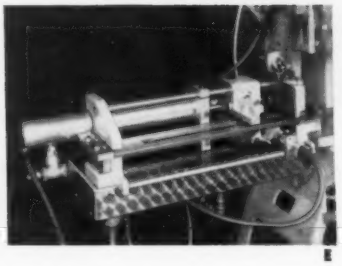


E

Ask for Bulletin No. 85-M

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

ALSO

A ACC-1-9-C U. S. Multi-Roll Coil Cradle suitable for material up to 9" in width, O.D. up to 40", weight capacity 1,500 lbs. This Cradle is equipped with four power driven coil rest rolls, a pair of power driven take-out rolls (hinged for easy loading of coil), crank adjustable side plates for quick adjusting and centering to width of coil, micro switch loop control arrangement, adjustable time delay relay, and 1/3 HP geared motor for output speeds up to 80' per minute for operation on 220/440 volts, 3 phase, 60 cy. A. C.

B PDS-4½ U. S. Power Driven Straightener, cabinet-mounted type, suitable for material up to 4½" in width, thickness up to approximately 3/32". Arranged with a pair of power driven take-in rolls and six straightening rolls (upper three individually adjustable and lower three power driven). Straightener assembly is of hinged construction so that it can be opened for easy threading of the end of a new coil. Standard equipment includes forward, stop and reverse controls, indicators on straightening rolls, casters for portability, micro switch loop control arrangement and ½ HP variable speed drive motor for operation on 220/440 volts, 3 phase, 60 cy. A. C.

C PDSC-948 U. S. Combination Power Driven Straightener and Coil Cradle suitable for material up to 9" in width, coils with O.D. up to 48", thickness capacity 3/32", weight capacity 2,000 lbs. Straightening unit arranged with a pair of power driven take-in rolls, six straightening rolls (lower three power driven), hinging arrangement on upper straightening rolls for ease in threading thin material or to facilitate the cleaning of the straightening rollers. Cradle to be arranged with five plain coil rest rolls, a pair of adjustable side frames. Including micro switch loop control arrangement, variable speed drive with 2 HP motor with output speeds 49 to 197' per minute.

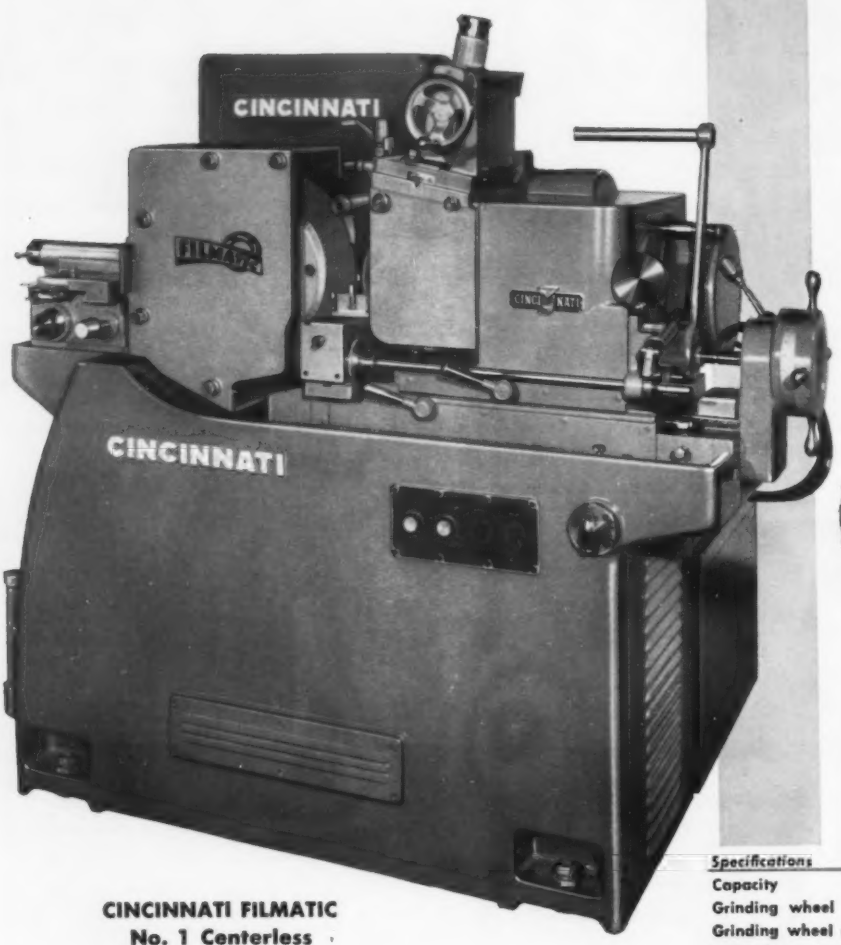
D SFC-6-24 U. S. Motor-Driven Cabinet-Mounted Slide Feed suitable for material up to 6" in width and feeding length adjustable up to 24" at one stroke.

E Two ASF-12 U. S. Air-Operated Slide Feeds, open side type, mounted on press, one Feed to feed left to right and one front to back.

For more information fill in page number on Inquiry Card, on page 195

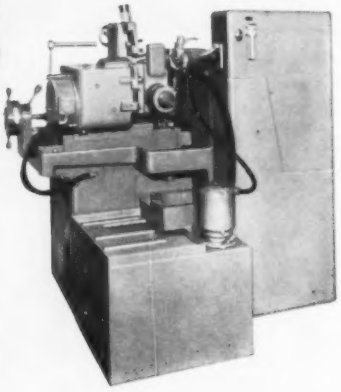
No. 1

. . . a new size in the Cincinnati Filmatic Line



CINCINNATI FILMATIC
No. 1 Centerless
Grinding Machine
Catalog No. G-703

Accessible grinding fluid tank and engineered electrical control cabinet are evident in the rear view.



Specifications	
Capacity	0 to 1½" diam.
Grinding wheel	16" diam. x 4" wide
Grinding wheel drive	7½ hp
Regulating wheel speeds	22 to 300 rpm
Floor space (standard)	63" x 61"

CINCINNATI®

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES •

# of Fine Centerless Grinding Machines

Cincinnati, the world's most experienced builder of centerless grinding machines, presents the new No. 1 size. It has the potential to reduce costs in every shop concerned with precision cylindrical grinding of parts ranging up to 1½" diameter. Many interesting features and construction details give these machines the highest performance rating:

Exclusive FILMATIC grinding wheel spindle bearings . . . over 99% of these bearings on all CINCINNATI Grinding Machines have never required service

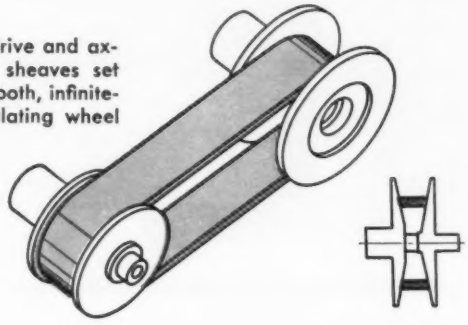
Swivel mounted regulating wheel unit . . . reduces set-up time

Automatic and oil shot lubrication

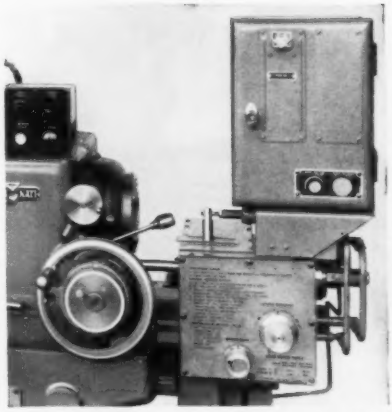
Engineered electrical control cabinet . . . controls are protected from damage and tampering

Selection of nineteen attachments and extra equipment items . . . spindle axial adjustment, crush truing, automatic grinding wheel spindle reciprocation, etc.

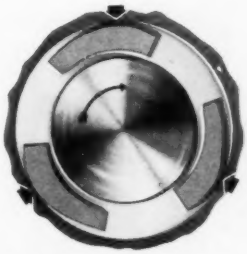
Many additional features, advantages and complete specifications will be found in catalog No. G-703. And Cincinnati gives you an additional advantage not found in catalogs—ENGINEERING SERVICE. ¶ Cincinnati is ready to study your precision grinding methods and recommend improvements wherever possible. May we hear from you?



V-belt primary drive and axially adjustable sheaves set the stage for smooth, infinitely variable regulating wheel speeds.



For high production infeed work, the Electro-Hydraulic Automatic Infeed Attachment is a top-notch performer. Infeed rates and stock removal are dial adjusted.



FILMATIC grinding wheel spindle bearings just never wear out or require adjustment.

CINCINNATI

MACHINES • MICRO-CENTRIC GRINDING MACHINES
CHUCKING GRINDERS • CENTERLESS LAPPING MACHINES

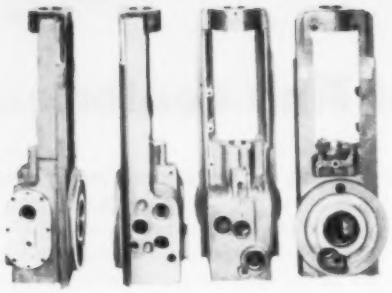
CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

For more information fill in page number on Inquiry Card, on page 195

Tool slides precision
with BURGMASTER

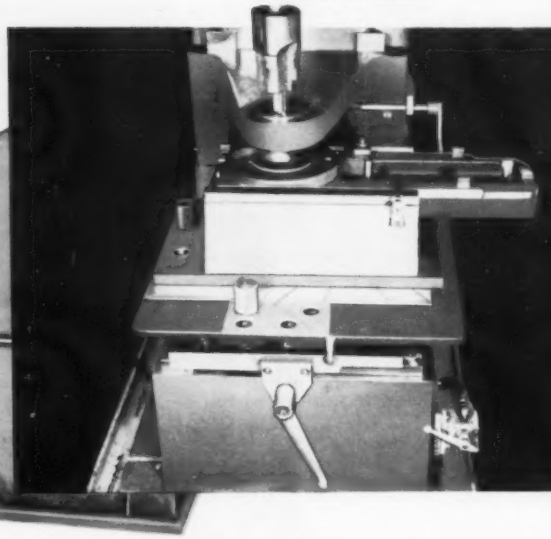
TWO MODELS AVAILABLE

2BH—6 spindle—¾" capacity
3BH—8 spindle—1½" capacity



Tool slides showing all four sides from which precision machining operations are performed.

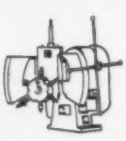
Close-up view showing pin locator air locked fixture for holding tool slide in first set-up. Other fixtures are similar.



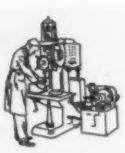
Specialists in High Production Turret Drilling

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

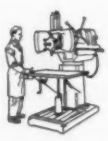


2BF Flange Mounted Power Index ¾" Capacity



2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



2BR Ram Type Radial Drill ¾" Capacity

2PT-3PT Automatic Tape Controlled ¾" and 1½" Capacity

machined *5 times faster*

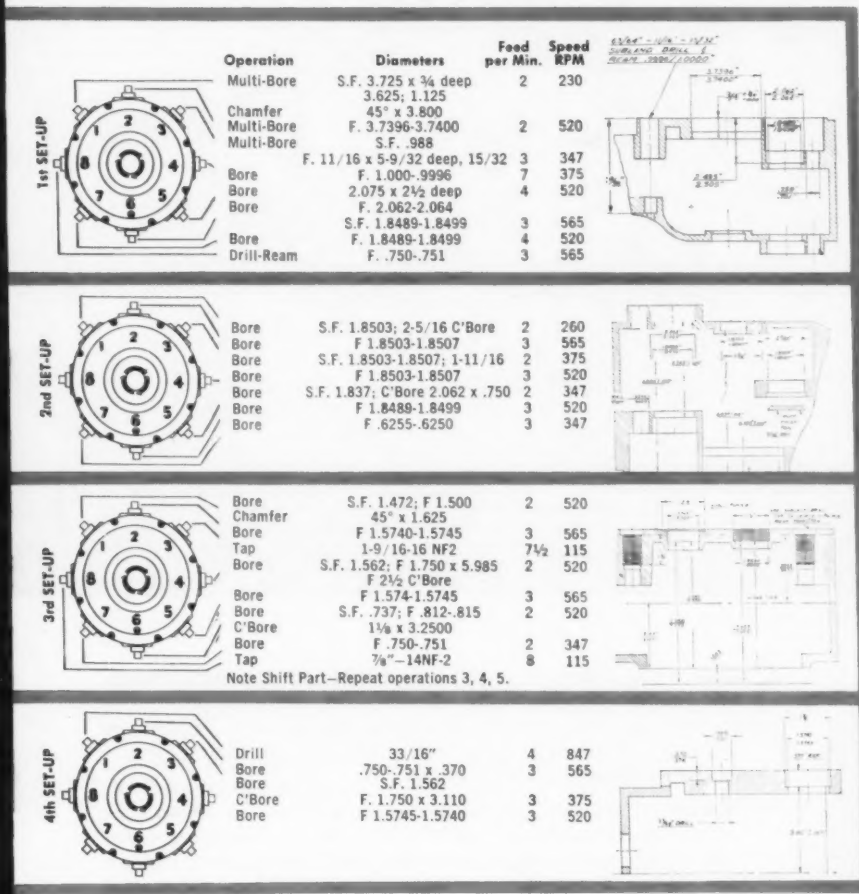
AUTOMATIC HYDRAULIC 8-SPINDLE TURRET DRILL

(1½" CAPACITY)

Burgmaster Automatic Hydraulic Turret Drills are designed to give both precision and speed. On machine slides, 26 operations on 14 centers are now machined in 2.5 hours average, which formerly required 12.5 hours on a horizontal boring mill—a saving of 80%. These operations include drilling, boring, reaming, spotfacing, and tapping, with bores held to .0004" tolerance and centers to .001". **Although the machine is used for many other jobs, this one alone repaid its cost in 1½ years.**

Automatic hydraulic machine operation is the answer which provides power indexing to the eight-spindle turret, pre-selects spindle speeds, provides infinitely variable pre-selective feeds, rapid approach and return, and accurate depth control. All operations are carried out at their most efficient rate for high finish, precision, accuracy, speed, and longest tool life.

Burgmaster engineers are prepared to suggest similar savings on your work. There is a Burg direct representative or dealer near you—consult them freely—there is no obligation.



	Operation	Diameters	Feed per Min.	Speed RPM
1st SET-UP	Multi-Bore	S.F. 3.725 x ¾ deep 3.625; 1.125	2	230
	Chamfer	45° x 3.800		
	Multi-Bore	F. 3.7396-3.7400	2	520
	Multi-Bore	S.F. .988 F. 11/16 x 5-9/32 deep, 15/32	3	347
	Bore	F. 1.000-.9996	7	375
	Bore	2.075 x 2½ deep	4	520
	Bore	F. 2.062-2.064 S.F. 1.8489-1.8499	3	565
	Bore	F. 1.8489-1.8499	4	520
	Drill-Ream	F. .750-.751	3	565
2nd SET-UP	Bore	S.F. 1.8503; 2-5/16 C'Bore	2	260
	Bore	F 1.8503-1.8507	3	565
	Bore	S.F. 1.8503-1.8507; 1-11/16	2	375
	Bore	F 1.8503-1.8507	3	520
	Bore	S.F. 1.837; C'Bore 2.062 x .750	2	347
	Bore	F 1.8489-1.8499	3	520
	Bore	F .6255-.6250	3	347
3rd SET-UP	Bore	S.F. 1.472; F 1.500	2	520
	Chamfer	45° x 1.625		
	Bore	F 1.5740-1.5745	3	565
	Tap	1-9/16-16 NF2	7½	115
	Bore	S.F. 1.562; F 1.750 x 5.985 F 2½ C'Bore	2	520
	Bore	F 1.574-1.5745	3	565
	Bore	S.F. .737; F .812-.815	2	520
	C'Bore	1⅛ x 3.2500		
	Bore	F .750-.751	2	347
	Tap	⅞"—14NF-2	8	115
	Note Shift Part—Repeat operations 3, 4, 5.			
4th SET-UP	Drill	33/16"	4	847
	Bore	.750-.751 x .370	3	565
	Bore	S.F. 1.562		
	C'Bore	F. 1.750 x 3.110	3	375
	Bore	F 1.5745-1.5740	3	520

How the job is run

Machine: Burgmaster 3BH Automatic Hydraulic 8-Spindle Turret Drill.

Part: Machine Slide.

Material: Close grain Moly Cast Iron.

Quantity: 50 per batch.

Holding: Special Pin Locator Air Locked Fixture, for each Set-up.

Closest Tolerances: .0004" on Bores, .001" between Centers.

Tooling: Carbide Tipped Tools.

Floor to Floor Time: 2.5 hours

Former Time: 12.5 hours each on Boring Mill.

Saving: 10 Hours each or 80%.

Write for bulletin describing Burgmaster 6 and 8 spindle Automatic Hydraulic Turret Drills in detail. Twenty-minute 16mm sound film showing Burgmaster turret drills in operation, including the new automatic positioning table, available from any office.

BURG TOOL

MANUFACTURING COMPANY, INC.

15001 South Figueroa Street, Gardena, California

FAculty 1-3510 DAvis 9-4158

BURGMASTER DIRECT SALES OFFICES:

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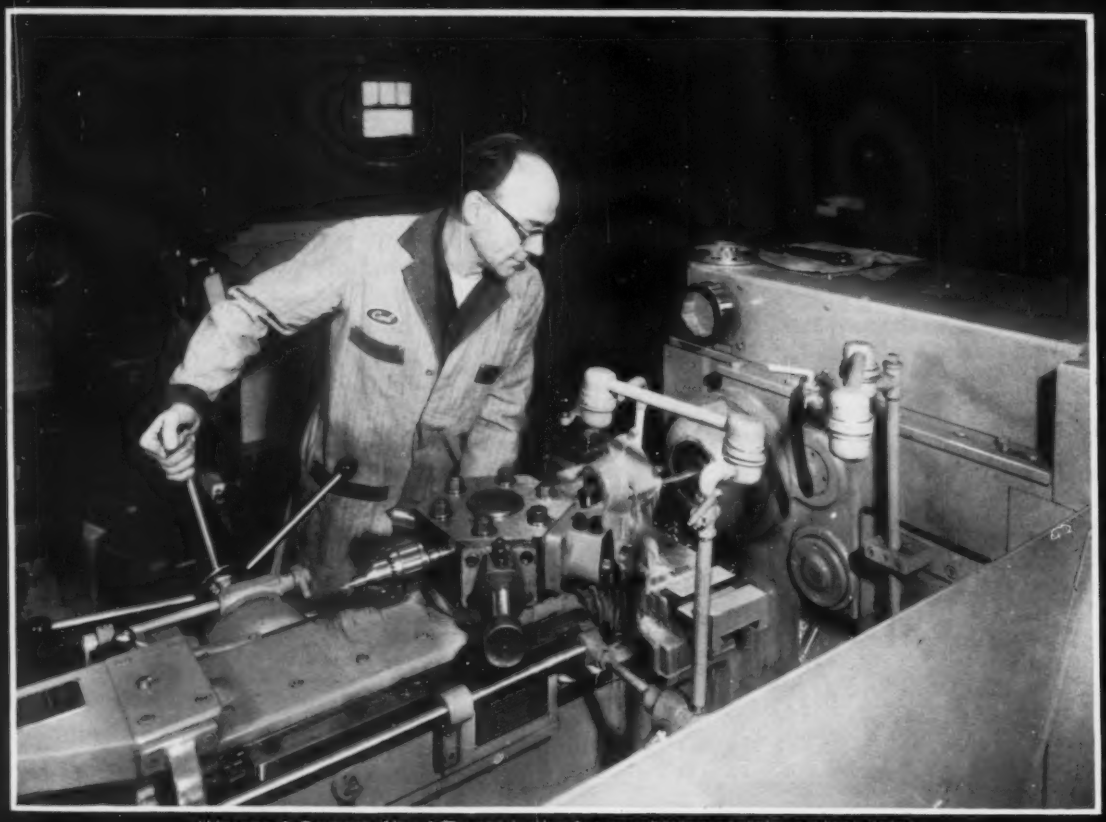
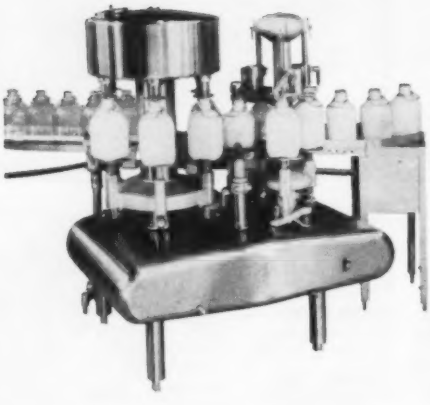
Plus dealer representatives in other industrial centers.

WARNER & SWASEY NO. 4



Warner & Swasey No. 4 Turret Lathe for machining stainless steel dairy equipment components (shown at right) at Federal Mfg. Co., Milwaukee, Wisc.



SPECIALIST PRODUCER of milk bottle filling and capping machines, Milwaukee's Federal Mfg. Co.—a small, but most progressive organization—is today enjoying a phenomenal growth. This is due to the dairy industry's enthusiastic acceptance of their new and unique 'Vacu-Matic' filling machines.

PROBLEM—Precision components of these machines—produced in average lots, ranging from 100 to 300 pieces—are of 303 stainless steel. Required machining tolerances were .0005", and surface finishes of 40 micro-inches had to be held in order to keep subsequent polishing costs to a minimum.

SOLUTION—Federal's Warner & Swasey No. 4 Ram Type Turret Lathe, combined with operator skill and a sound preventive maintenance program, adequately met the desired accuracy and surface finish specifications—and, in addition, increased production three times above rates obtainable on their older turret lathes.

YOU CAN PRODUCE IT BETTER,

HOLDS .0005" ACCURACY...

triples production rate for Federal Mfg. Co.

OPERATOR REPORTS—"Ease of machine handling made possible our sizable production increase. We make full use of the lathe's 6 to 1 high-low shift and two-speed motor which instantly and effortlessly provide a choice of four speeds without preselection—a time-saver for changing speeds from turn, to ream, to cut off, etc. In all, our new No. 4 all-clutch hydraulic headstock, with its two-speed motor, provides a total of 24 *unduplicated* speeds—any of which can be preselected while under cut, and instantaneously thrown into action by the flip of a lever. We also like the higher speeds and the easier, faster handling of the apron controls."

This is the kind of production you can expect in your own shop when you replace older turret lathes with modern Warner & Swaseys. Call in our Field Representative to talk about specific applications in your shop.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

FASTER, FOR LESS... WITH A WARNER & SWASEY

For more information fill in page number on Inquiry Card, on page 195

JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it

Out-of-this-World Accuracy

Whether they're destined to go "out of this world" or not, many jobs demand some "out of this world" machining. Here's one, on a J & L lathe which is adapted for two-way tracing from the hexagon turret. Critical dimensions on both internal and external tapers, plus several intricate contours are finish-machined in one chucking.

A three-way indexing template holder is push-button controlled. Thus, down-time for template changes is eliminated, and the 180° tracer continues to machine on both the forward and return feed of the saddle carriage.

A single selector switch disengages the tracing unit and the machine is ready for normal* turret lathe operations.

*("Normal" for J & L turret lathes means unsurpassed accuracy, high production, and low, low maintenance.) For details, write for our descriptive folder No. 5425. Jones & Lamson Machine Company, 512 Clinton St., Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Precision Boring Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

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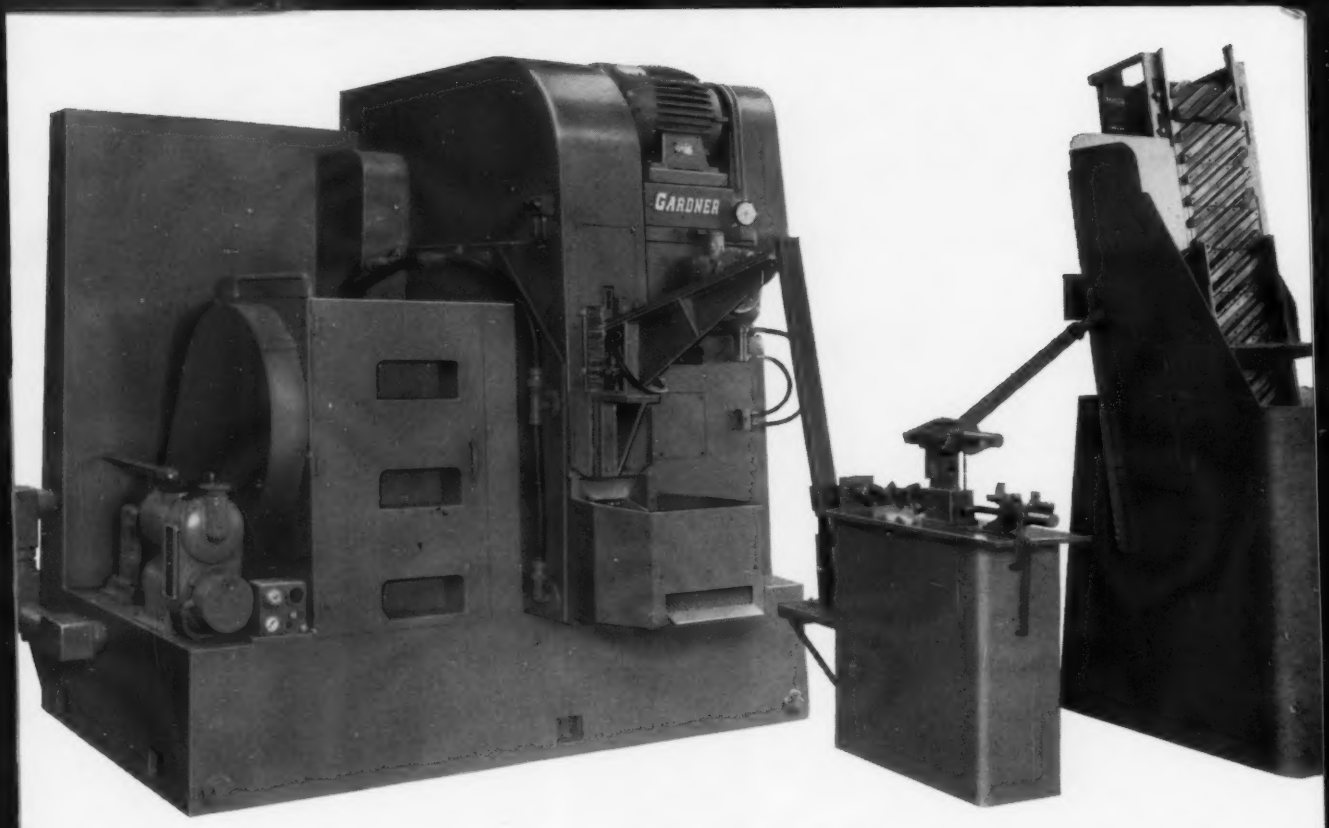
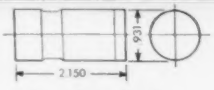


Gardner 723-23″ dual horizontal spindle grinder rough and semi-finish grinds 3000 valve lifter bodies per hour.

Gardner automatic operation increases output . . . grinding hydraulic valve lifter bodies

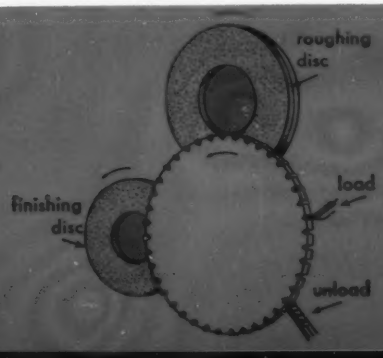


production data

Operation.....Grinding closed end of hydraulic valve lifter body
Material:.....Cast iron
Rate:.....3000 per hour
Stock Removal—
Rough cut: .....012″-.038″
Semi-finish cut: .....006″-.008″
Uniformity:.....002″
Squareness:.....0005″

special machine equipment

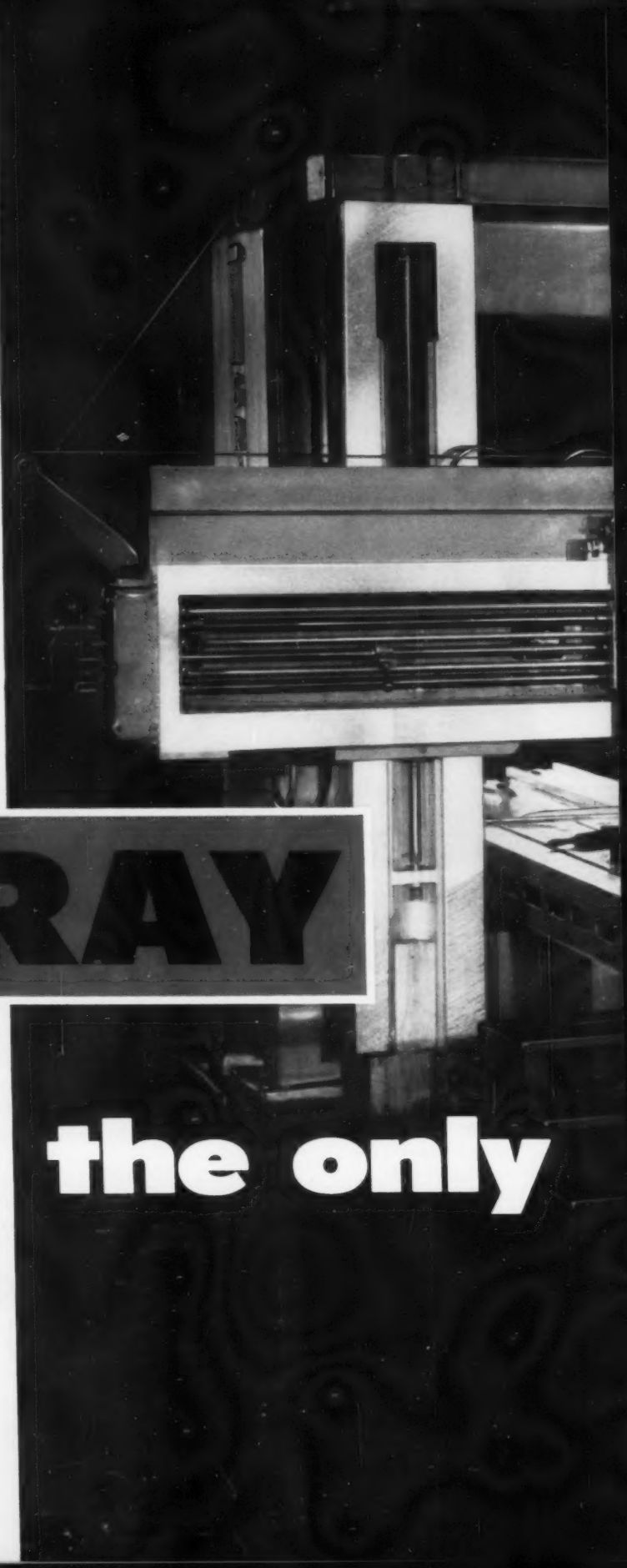
hopper feed
transfer attachment
automatic loading and unloading
rotary carrier
two Gardner sizing units with automatic feedback
centralized lubrication
head zeroing gages
power-operated increment head feed
30″ & 23″ Yellow-Rim Wire-Lokt® discs



GARDNER

precision disc grinders

BELOIT, WISCONSIN



heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.

double-cutting

The flick of a lever, the touch of a button permits double-cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.

triple-cutting

Rough and rough-finish plane at the same time. Rough by double-cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

a GRAY the only

This new 84" x 60" x 18' Gray Universal Planer shown in operation at the Koppers Co., cuts going – cuts coming, removes big chips at double rate. There is no idle return stroke to waste precious production hours. Instantaneous reversals with heavy duty double-cutting make this the first REAL new development in modern planers ...*a GRAY exclusive.*

Double tables further virtually eliminate the costly set-up time required by ordinary planers.

The multiple savings received by users of the new Gray Universal make it a wise investment.

If it's new... it must be a GRAY.

The G. A. GRAY Co.,
Cincinnati, Ohio

GRAY Universal Planer shown in operation at the Baltimore plant of Koppers Company, Inc., Metal Products Division.

new planer

Willis Ehrhardt tells how Moore Jig Borers and Jig Grinders built nation-wide service

This is another in a series featuring the views of owners of leading contract tool and die companies

by **WILLIS G. EHRHARDT**
Managing Partner
Ehrhardt Tool & Machine Company
St. Louis, Mo.
Specialist in High-Precision
Gages and Dies

"'*A nation-wide service for the few who want the most in precision dies, tools and gages.*' That's what we claim; that's what we do. And the backbone of the facilities which enable us to provide this service, is our Moore Jig Grinding and Jig Boring equipment.

"We were the first contract tool and die company in our area to install these versatile machine tools years ago, and we've added the new models promptly. In addition to helping us maintain the highest precision standards, their very flexibility of application brings in a caliber of work which is often beyond the scope of toolrooms and of competition.

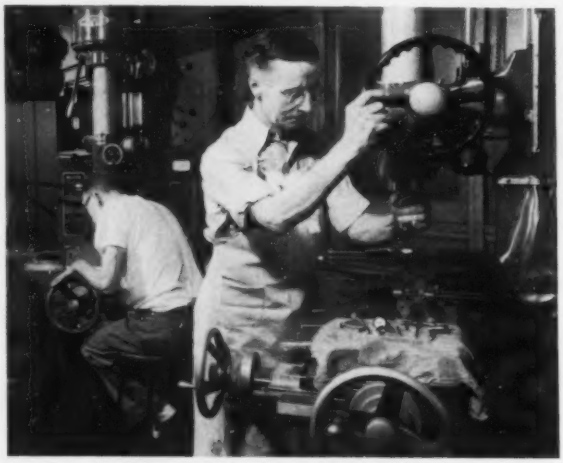
"We are quite proud, for example, of an *all-ground die*, machined entirely on the Moore Jig Grinder, *in hours*. Formerly, we could not have tackled its complex contours and holes. Equally intricate operations have been performed by our Moore Jig Borers.

"Beyond a doubt, the speed, ease of operation and high-precision of our Moore equipment for holes, contours and surfaces are prime factors in keeping us 'first on the Mississippi'."

Can Moore equipment cut costs in *your* toolroom? Moore shows you the way—with literature describing the features of these machines and how they can be used to your profit. For copies, just write...

MOORE SPECIAL TOOL COMPANY, INC.
734 Union Avenue, Bridgeport 7, Connecticut

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. $5 in U.S.A., $6 elsewhere.



"MOORE JIG BORERS have proved a profitable investment from their first day of use. They've enabled us to spot, drill, ream and bore, at higher precisions, and faster, than any previous equipment. Carbide die work seems to be their 'cup of tea'."

"OUR MOORE JIG GRINDER has established a record of trouble-free performance absolutely unmatched... especially remarkable in view of the many 'trick' operations it is called upon to handle."

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

For more information fill in page number on Inquiry Card, on page 195

Missing Something?

The Answer is Pink!

Switch to PINK CIMCOOL

Yes, if you're missing that extra something in *your* shop, try CIMCOOL for metal cutting jobs. The famous CIMCOOL° family of cutting fluids covers every job, every type of work and metal. Discover how the famous pink cutting fluid can lower costs and increase production in your plant.

Here are three reasons why CIMCOOL has become the largest selling chemical cutting fluid in the world:

CIMCOOL LOWERS COSTS because it's longer lasting in machines. Therefore, it reduces downtime and cuts labor costs for cleaning and changing.

CIMCOOL PERMITS FASTER SPEEDS and feeds, because of its chemical lubricity. It combines friction reduction and cooling capacity in a degree never before attained by old fashioned lubricants.

CIMCOOL IS CLEANER TO USE because it doesn't soil hands or clothing. It contains no skin irritants. And it's safer because it leaves no slippery film on shoes, floor, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So don't keep things *under* your hat . . . call your CIMCOOL Distributor today. He'll be glad to give you full information on all the advantages of CIMCOOL Concentrate—as well as details on the entire family of CIMCOOL Cutting Fluids. YOU may be missing something!

Or contact us direct and we'll have one of our Cincinnati Milling trained machinists call on you—without cost or obligation, of course. Write, wire or telephone, Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

CIMCOOL CUTTING FLUIDS

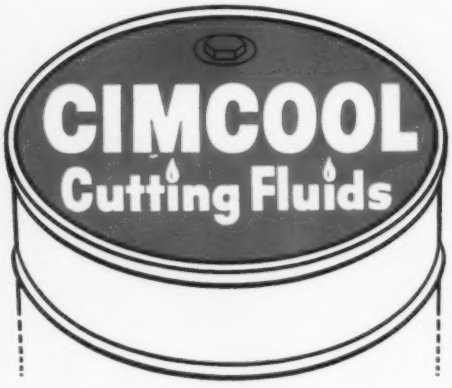
CIMCOOL 52 Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMPLUS—The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Concentrates (AA, NC, 55)—For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

Also, CIMCOOL Bactericide and CIMCOOL Machine Cleaner.

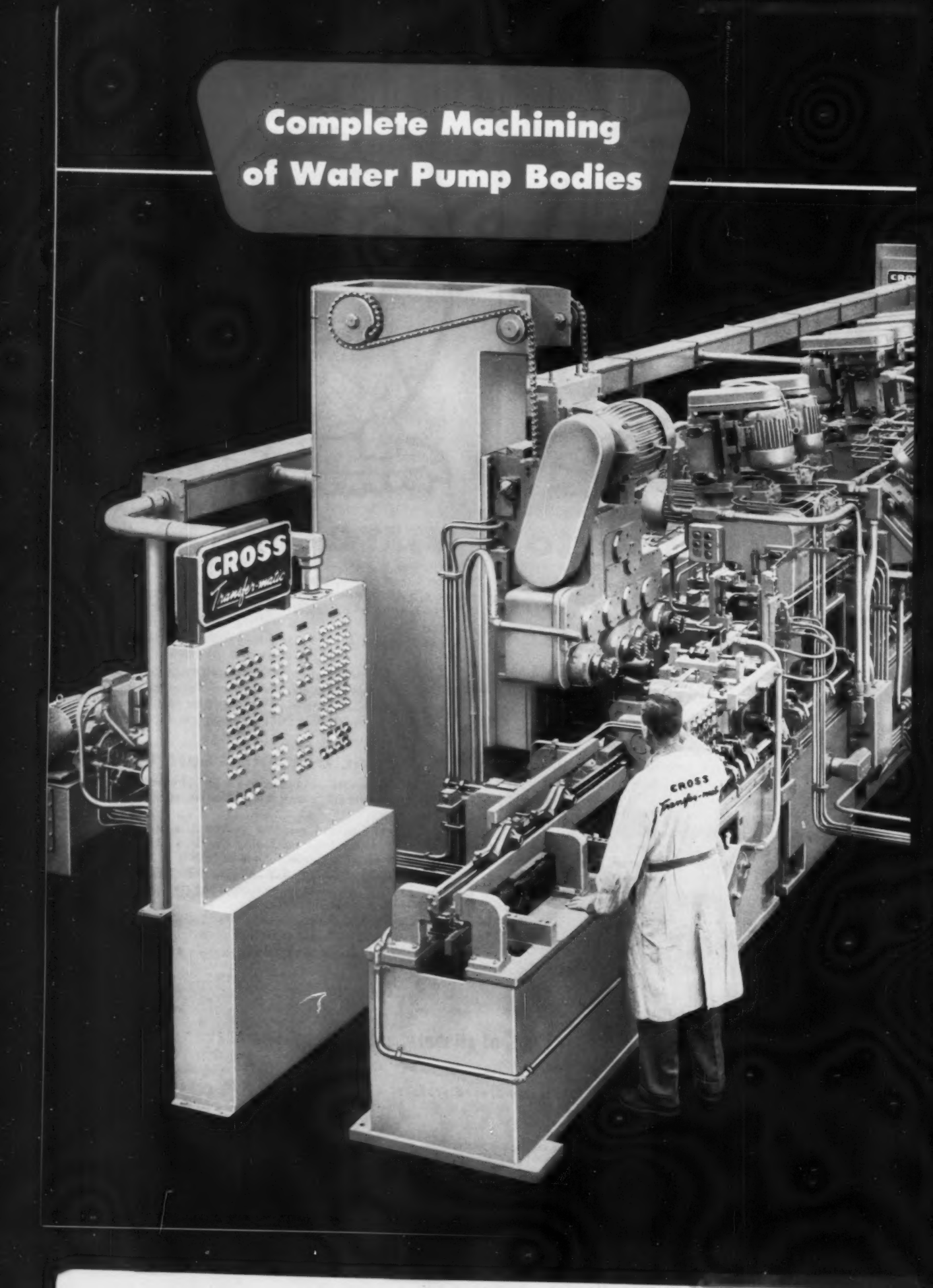


for 100% of all metal cutting jobs. The Answer is Pink!

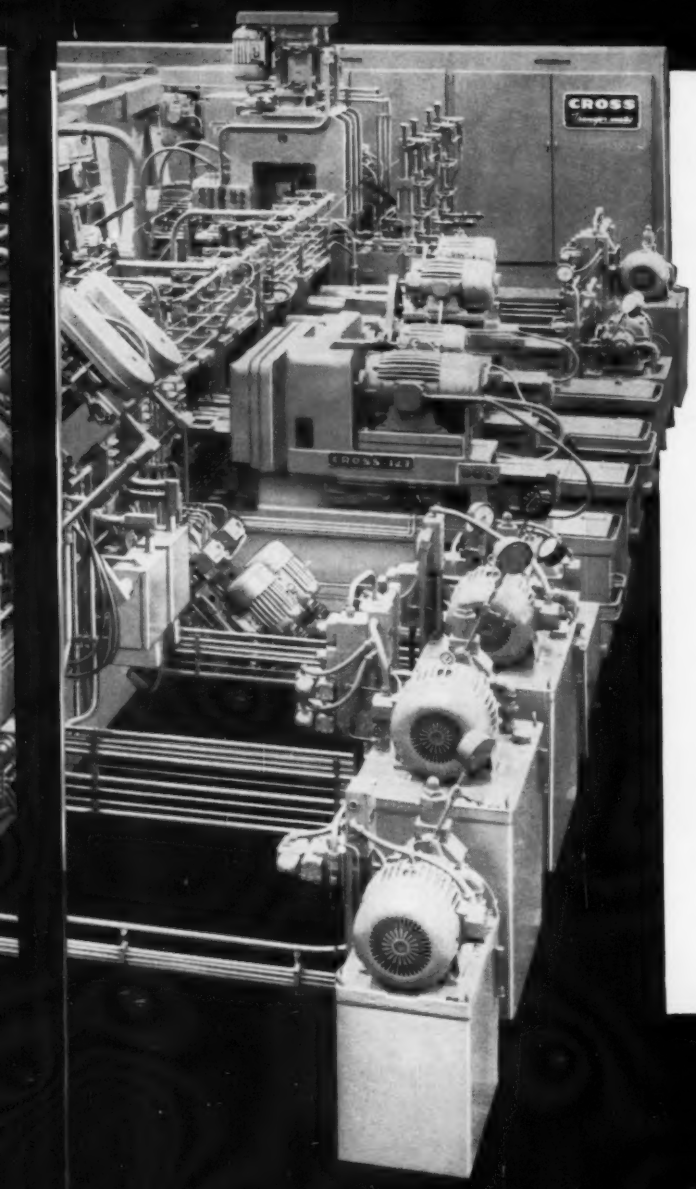
Production-proved products of The Cincinnati Milling Machine Co.

° Trade Mark Reg. U.S. Pat. Off.

Complete Machining of Water Pump Bodies



Another Transfer-matic by Cross



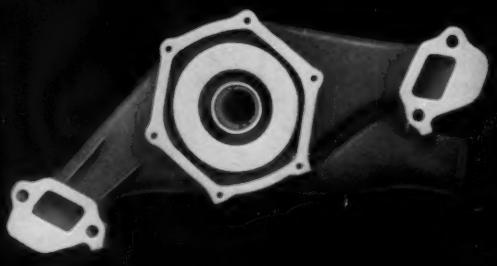
- ★ Machines two castings simultaneously at rated capacity of 200 pieces per hour.
- ★ Station 1 load; Station 2 mills mounting faces; Station 3 drills thermostat by-pass hole, mainshaft hole and four mounting holes; Station 4 cross-faces cover face and drills one angular vent hole; Station 5 chamfers thermostat by-pass hole, drills six cover holes, spot-faces mainshaft hole on inside; Station 6 cross-faces impeller face, reams thermostat by-pass hole and drills second angular vent hole; Station 7 spotfaces and chamfers mainshaft hole, spotfaces four mounting holes and drills by-pass hole on inside; Station 8 finish cross-faces impeller face and recesses center of mainshaft hole; Station 9 semi-finish bores mainshaft hole; Station 10 finish precision bores mainshaft hole; Station 11 tap drills heater connection hole and probes cover holes; Station 12 taps heater connection hole and six cover holes; Station 13 automatically unloads two pump bodies.
- ★ Locating: in Station 2, parts are located from foundry pads; in Station 3, from milled faces and cored water passages; and, from Station 4 on, from milled faces and two mounting holes.
- ★ Cross' "building block" principle provides flexibility for future part design changes.
- ★ Other features include: complete interchangeability of all standard and special parts for easy maintenance, construction to JIC Standards, hardened and ground ways and automatic lubrication.

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



Gray* Tool Company

buys a G&L

HYPRO 54-inch Vertical Boring and Turning Mill

World's first numerical path-controlled Vertical Boring Mill automatically reproduces parts... eliminates error!

Gray Tool Company, Houston, is the *first general purpose metalworking firm* to take advantage of the big cost-saving production benefits of a G&L HYPRO Vertical Boring Mill equipped with G&L's NUMERICORD numerical continuous-path control for multi-axis machine tools.

This outstanding G&L combination equips this progressive oilfield equipment manufacturer to offer both remarkably fast production and fast replacement service.

Error, scrap, template manufacture, and storage expenses are eliminated. Now Gray can reproduce identical workpieces in small or large lots . . . and can *economically* and *identically* duplicate them at any time.

The G&L Vertical Boring Mill is equipped with a 5-position turret head and a ram-type rail head. The NUMERICORD magnetic tape automatically controls all machine functions and work cycles. The machine provides 16-feed selections and constant SF/M cutting speed to table.

G&L HYPRO Vertical Boring and Turning Mills are available in 12 models . . . table diameters from 54" to 14' . . . table work load capacities to 125 tons . . . motor drives to 150 hp. For further details, including NUMERICORD control data, see your nearest G&L representative or write G&L direct.

G&L HYPRO Vertical Boring and Turning Mill

Here's the world's first Vertical Boring and Turning Mill equipped with NUMERICORD system of machine tool automation for Gray Tool Company of Houston, Texas. (Control console at right of machine). NUMERICORD system provides a "complete store of skills" . . . makes workpiece accuracy a function of engineering planning! Tolerances are easily held within working limits of the machine. On every job, elimination of non-cutting intervals is achieved. This adds up to very substantial time-savings.

✻ **Gray Tool Company of HOUSTON, TEXAS**

Manufacturers of specialized drilling and production equipment for the oil industry.

G&L *and* HYPRO DIVISION

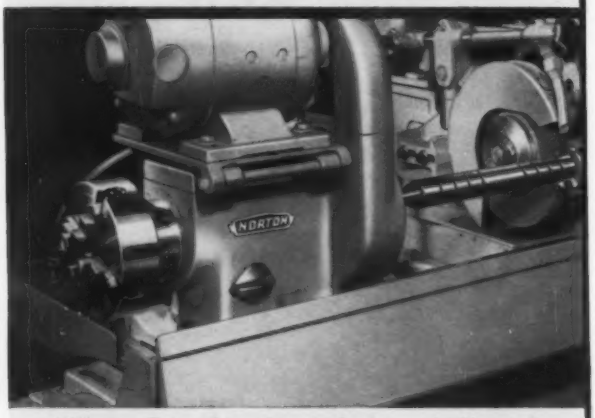
GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN G-90

Builders of the world's finest heavy-duty Table, Floor and Planer Types Horizontal Boring, Drilling and Milling Machines; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring and Turning Mills; Spar and Skin Milling Machines, VARIAX Milling Machines and NUMERICORD-numerical continuous path tape controls.

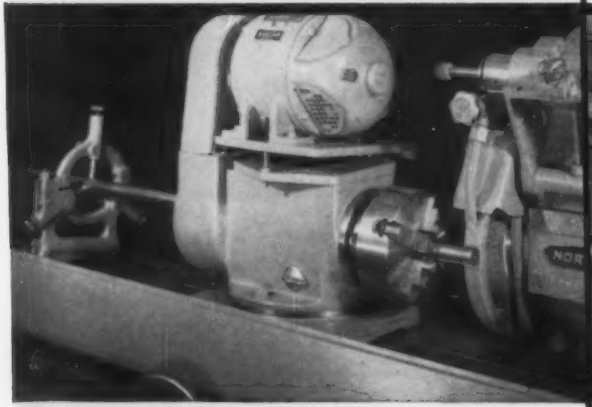
Norton builds extra versatility into universal grinders...

JOB-SPEEDING FEATURES

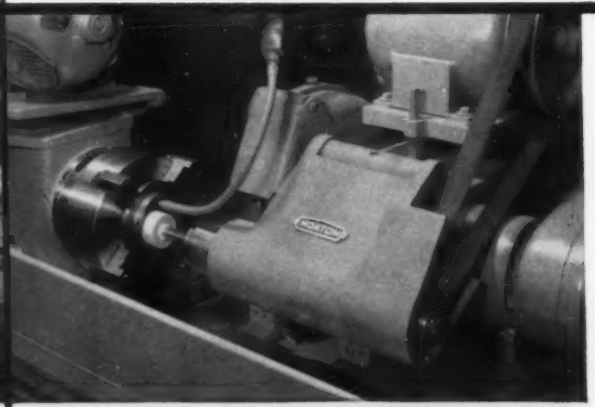


Minimum effort to change from dead center to chucking work. Chuck may remain mounted at back end of headstock while dead-center grinding.

to put extra dollars in your pocket

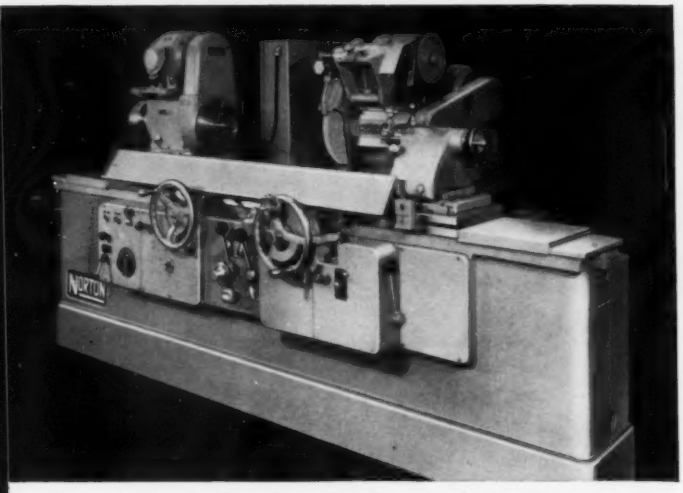


Hollow headstock spindle gives you additional capacity for grinding long bars by passing them clear through and supporting them in grinding position.



Hinged-bracket type internal grinding spindle swings up and out of the way when not in use. This means quicker setups for your I.D. or O.D. grinding.

Norton 10″ universal grinder. Made with 20″ or 24″ nominal lengths between centers. Catalog 170.



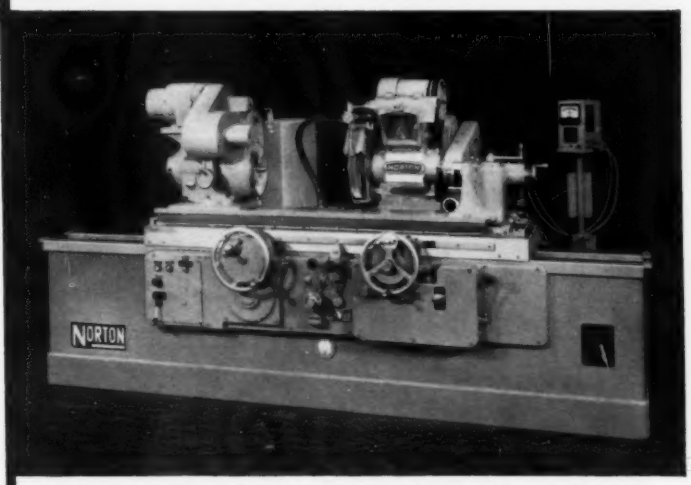
Norton 12″ Type U-4 universal grinder. Made with 36″ or 48″ nominal lengths between centers. Catalog 231.

Many a user rates his Norton universal grinder as a practically "complete grinding department." Why? Because Norton builds extra versatility into its universals for faster external, internal, face, taper and angular wheelside grinding, including many special jobs. Also they're built with many famous job-speeding, cost-cutting features: For example:

Extremely rapid chucking . . . quick change-over to live or dead spindle operation . . . easy work speed changes . . . independent wheel settings that do difficult jobs fast . . . extra capacities on wheel head and headstock . . . precise swivel table alignment with the SWIVALIGN *Dual Electric Indicator, an optional extra.*

Made In The Size You Need

Norton universal grinders are made in 10″, 12″, 14″ and 18″ swing capacities. That means you can get exactly the size to bring you many time-and-money-saving "Touch of Gold" advantages. For complete facts on these high-efficiency machines see your Norton representative or write us direct. And remember: Only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.



Norton 14″ Type U-4 universal grinder. Made with 36″, 48″ or 72″ nominal lengths between centers and also in 18″ swing capacity. SWIVALIGN* Dual Electric Indicator, at right of picture, measures swivel table adjustments and is optional on all Norton universal grinders. Catalog 819.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
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*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

BAUSH "SPECIAL" 3-WAY UNIT

DRILLS, ROUGHS, AND FINISH FORMS SPARK PLUG HOLES IN CYLINDER HEAD —

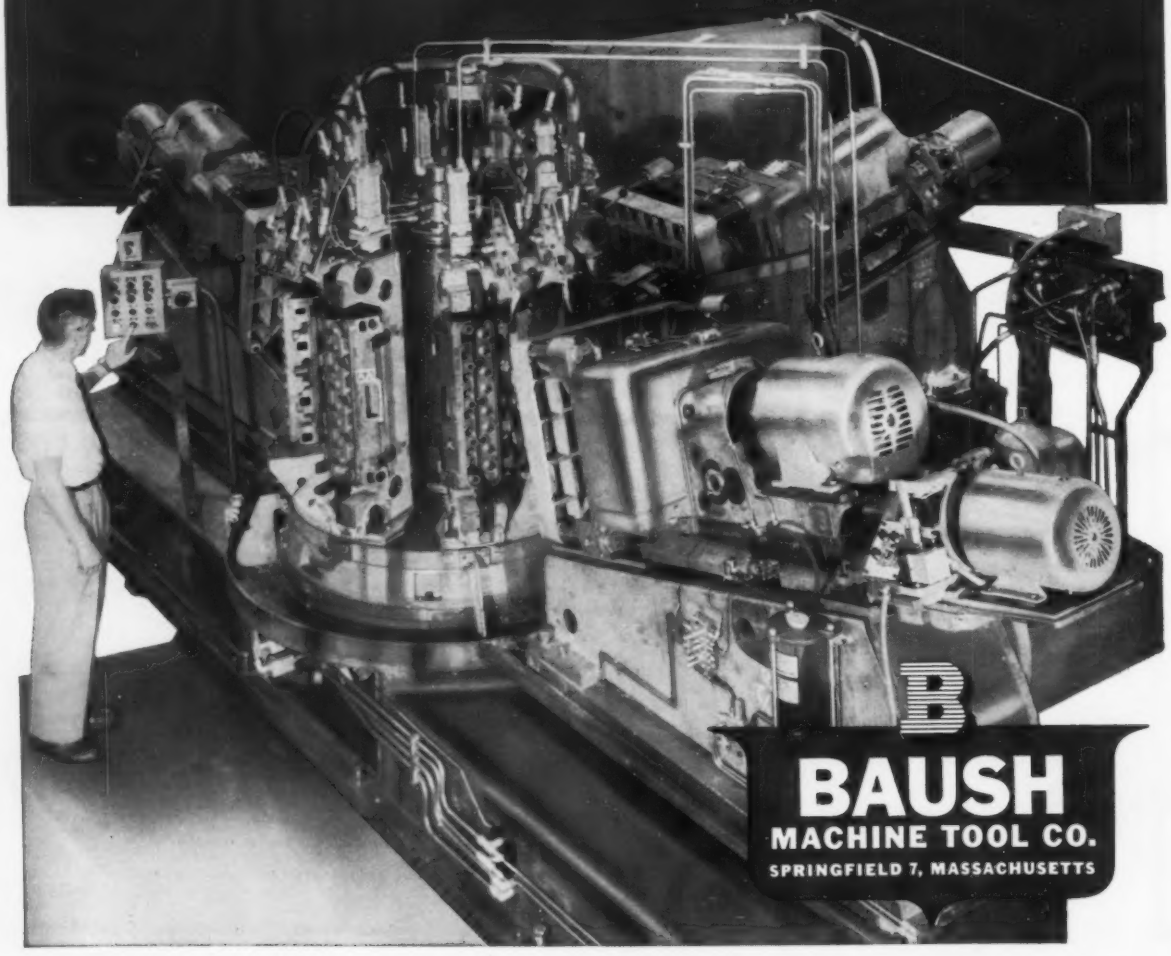
It is one of several different machines we have designed and are producing to complete a cylinder-head production line for a leading automotive manufacturer . . . resulting from past proven performance of other Baush units designed for specific jobs in this plant.

If you are thinking of AUTOMATION — THINK OF BAUSH. Our experience is yours — we'll gladly help with your machine tool problems.

SPECIFICATIONS:

Unit has 50" diameter, 4-station semi-automatic rotary table with a 2-position, 4-station fixture, plus full Trabon Lubrication. Three (3) 35° Vertical Angular Model "S" Mechanical Leadscrew units, each having a 4-spindle fixed center head, are mounted on a welded steel center base. Chip conveyor runs through machine.

Part is manually loaded into fixture and hydraulically located and clamped. Fixtures are equipped with guide bushing for tools and bars register in holding units when part is in machining position.



BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

For more information fill in page number on Inquiry Card, on page 195

PRODUCTION POINTERS from GISHOLT

MASTERLINE GISHOLT SINCE 1887

FISHER GOVERNOR COMPANY TRIMS F.T.F. TIME

Cuts costs through Fastermatic features and accessories

You'll find some good tips in this job story—tips that tell how Fisher Governor, Marshalltown, Iowa, cuts costs by taking full advantage of the features and accessories of the Gisholt MASTERLINE Fastermatic Automatic Turret Lathes.

The job is on cast-steel stuffing box heads. Two Gisholt 2F Fastermatics handle first, second and third machining operations.

Here's the machining sequence: (Sections in italics show where a specific machine feature or accessory is used to cut costs.)

Operation 10: Chuck on large O.D. X, locating at Z in 18″, 3-jaw air-chuck. *Hex turret is set at non-index* and rough-turns F-E. *Both front and rear cross slides operate during this one pass* to chamfer A and face B. F.t.f. time: 2.1 minutes.

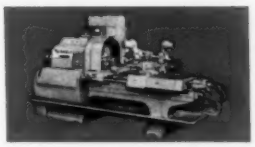
Operation 20: Chuck at X, locate at B in 18″, 3-jaw air-chuck. Hex 1: rough-bore P *while front cross-slide tools* rough-face Z, chamfer T, and *rear cross-slide tools* finish-face V-S. Hex 2: drill M, chamfer N and cut groove U. Hex 3: semi-finish bore M, size W, chamfer Y-O. Hex 4: semi-finish-bore P, chamfer R. Hex 5: finish-bore M and size P, holding to .001″. Hex 6: finish-ream P. Floor-to-floor time: 10.3 minutes.

Operation 30: Special fixture centralizes part on W, clamping back against Z with clamp at B. Hex 1: rough-turn F-E, chamfer corner at C, start-drill and rough-form J. Hex 2: drill K to depth, chamfering L at base of hole; semi-finish J and finish-turn F-E. Hex 3: semi-finish-bore K, chamfer J, using 10° finish-chamfering tool while *front cross-slide tools* finish-face H-D and chamfer G. Hex 4: finish-bore K. Hex 5: thread F, *using full-length lead screw threading attachment* and self-opening die-head. Hex 6: finish-ream K. F.t.f. time: 8.1 minutes.

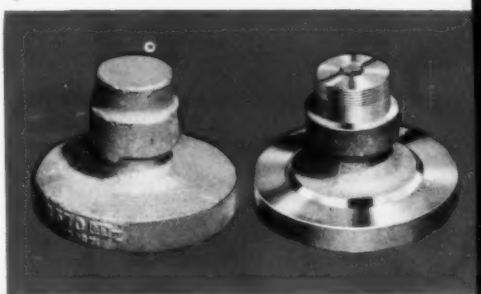
To eliminate tool tracks on all three operations, *both front and rear cross slides have .015″ tool relief in either direction*, used as required.

One operator handles both machines, uses simple Fastermatic Job Record Sheet to speed similar setups on variety of sizes. Full-length lead screw threading attachment provides accurate lead for threading.

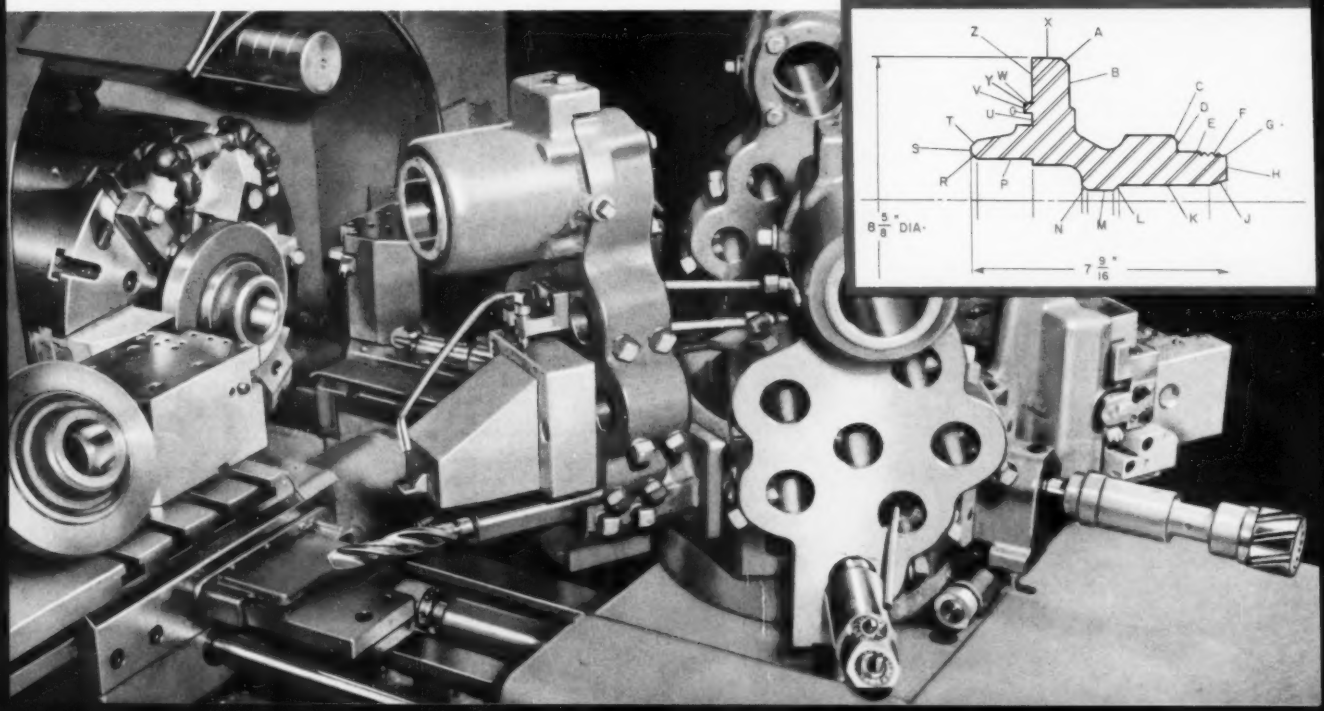
Ask for new Fastermatic Catalog 1179-B.



Rough workpiece and finished part showing surfaces machined in the three operations.



Second machining operation tooling and workpiece. Smooth hydraulic feeds assure accuracy and fine finish on all surfaces. Automatic cycle permits operator to handle second unit for maximum efficiency.



AIR BRAKE DIV. OF WESTINGHOUSE AIR BRAKE CUTS F.T.F. TIME 25%

Chucking fixture, special loader and cross-feeding turret simplify operation

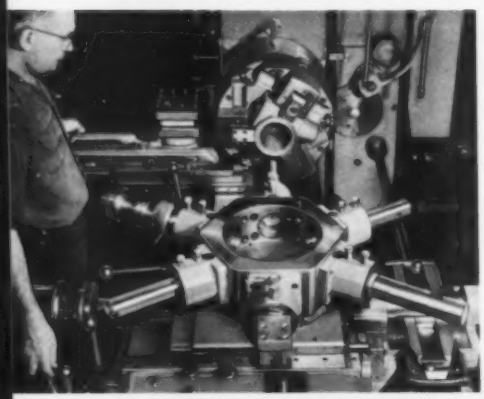
Here's a fixture job story to save for future reference. Previously, the workpiece—a cast iron, automatic slack-adjuster casing for railroad use—caused problems in both chucking and machining. Today, Westinghouse Air Brake Company's Air Brake Div., Wilmerding, Pa., plant is handling it in two fast operations. Here's how:

First, need for expensive special tooling is eliminated by using a Gisholt MASTERLINE 2L Saddle Type Turret Lathe, equipped with a cross-feeding hexagon turret with a taper attachment. Chucking the rough workpieces is fast and easy. A turret-mounted expanding loader-centralizer supports the part during loading in a 3-jaw, bonnet-type chucking fixture, operated by and mounted on the face of an 18″, 3-jaw air chuck. The piece is located longitudinally from the turret and chucked on the large 6⅜″-diameter flange, with three hand-clamp screws supporting the work at the rear.

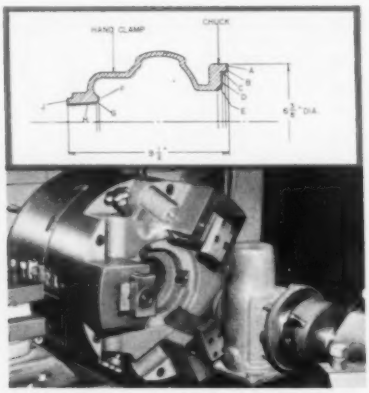
Let's look at the first machining operation. Surfaces are indicated on the drawing shown. Hex station 2 straight-bores H; station 3 rough-faces A-D, using hex turret cross feed with two tools in holder. Hex 4 straddle-faces F-J, using hex turret cross feed and two tools in bar, and reverse-feeds to finish surfaces and remove tool tracks. (Reverse feed is a standard feature on all Gisholt turret lathes.) Spindle rotation is reversed and tools on hex stations 5 and 6 rough- and finish-taper-bore H and chamfer G. Front square turret tools finish-bore C, finish-face A, chamfer B-E. Floor-to-floor time is a fast 8.4 minutes.

The same basic tooling arrangement handles the second operation on the other end of the part in just 5.5 minutes floor-to-floor time.

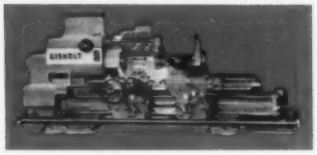
Special loader, designed by Westinghouse Air Brake tool engineers, speeds chucking operation. Standard tools on cross-feeding hex turret with taper attachment cut costs, handle straight or taper boring and facing operations to required accuracy.



First operation turret-tooling. Cross-feeding turret eliminates special tooling costs, handles taper-boring and cross-facing operations quickly and economically.



Turret-loader and chucking fixture. Three extended jaws chuck on 6⅜″-diameter flange, with one jaw pivoting for loading, unloading clearance. Part supported by hand-operated clamp screws at back of fixture.



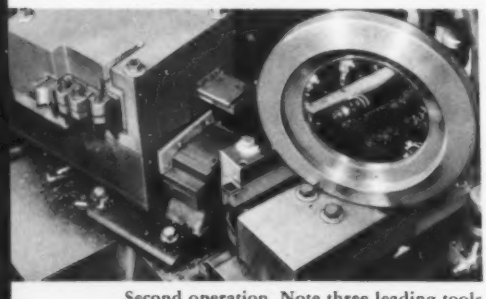
EXTRA OPERATIONS ELIMINATED WITH THIS SETUP

Combines table feed and slide movements to machine maximum number of surfaces in one chucking

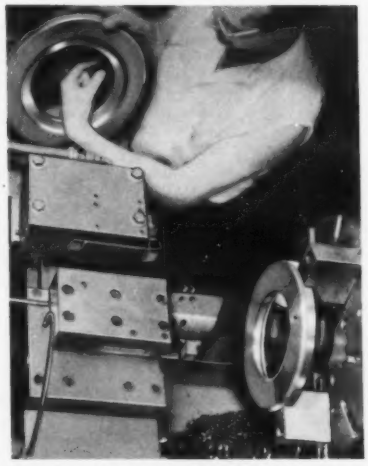
Here's another good job to add to your files. It shows you how to obtain complex feeding motions with minimum tooling investment, using the versatile Simplimatic. This setup handles two different sizes of steel rear-axle drive gears. 50 h.p. motor assures ample power for all cuts.

Check the first operation. A 21″, 3-jaw air-chuck grips the part on the large O.D., locating against the rough beveled face. The platen table traverses forward, then changes to feed as tools on the rear independent slide rough- and finish-bore. As this operation is completed, more tools on the rear slide, plus the front slide tools, are in position for machining. Moving back from the machine center line, standard rear slide feed movement back-faces and back-bores the web, and chamfers at the front and back of the bore. Rear slide tools then reverse-feed to eliminate tool tracks, clean up the cuts, and clear for withdrawal, while tools on the front independent slide face and chamfer the large O.D. The platen table then reverse-traverses and slides return-traverse to starting position. Complete f.t.f. time is only 2.35 minutes for the first operation.

The same operator handles another Simplimatic to perform the second operation on the other side of the part. Work is held in the bore with a 21″, 3-jaw air-chuck. This time the platen table merely positions the tools. Front slide movement turns the O.D. and forms a radius on the edge of the co-bore, while three cam-controlled tools on the rear independent slide rough- and finish-machine the beveled face and form a radius on the O.D. edge. F.t.f. time—2.5 minutes.



Second operation. Note three leading tools on rear slide, controlled by cam at rear of block to generate beveled face on part. Slide set at correct angle minimizes tool travel required from cam.



First operation tooling. Tools (facing operator) on rear slide rough- and finish-bore, using table feed. Tools on opposite side back-face, form co-bore and chamfer back edge, using standard slide movement.

Simplimatic handles extra surfaces through table feed combined with standard slide movement, eliminating extra handling and secondary operations. Flat platen table permits slide location at exact angle required, minimizing special tooling costs.

Ask for new Simplimatic Catalog 1159-C.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

HOW TO SPEED BALANCING AND CUT HANDLING COSTS

Integral correction unit lets operator complete balancing and correcting from one station

This setup shows how a well-known automobile manufacturer cut balancing time and costs on a variety of automatic transmission parts. It shows how the addition of a correction drilling unit to a standard Gisholt 1SV1 Balancer permits measurement, location, correction and inspection for balance to be handled from one station.

Here's how a first turbine disc and hub assembly part is balanced. Because the parts are narrow and of large diameter, only a single-plane balancing operation is required so the lower cost 1SV1 Balancer is ideal. Although location is in the splined bore, close balancing accuracy is easily maintained, using an air-operated expanding splined arbor.

A numbered disc rotates with the work. The unbalance angle is indicated on this disc by a strobe lamp in the same visual plane as the amount meter. The amount meter is calibrated in terms of drill depth. A graduated reference dial on the turnstile that feeds the drill permits the operator to drill to the indicated depth quickly, with minimum chance of error. He merely matches meter reading to the depth dial reading to correct for unbalance.

The drill head is mounted 30 degrees from the vertical for loading-unloading clearance. A hydraulic-operated thrust support at the base of the part compensates for vertical and horizontal thrust during the correction drilling.

Workpiece shown on adapter. Note numbered reference dial for fast, accurate angle location and hydraulic-operated thrust support at base of part.

Note simple, compact arrangement that permits measuring, locating, correcting and inspecting for balance at one station.

A production rate of 60 pieces per hour is realized by adding a correction drilling unit to the standard 1SV1 Balancer. Saves time, requires minimum floor space, prevents error by letting one operator perform all necessary operations.

POWERS REGULATOR SAVES 40% ON THESE PARTS

Hydraulic drive automates production, improves quality

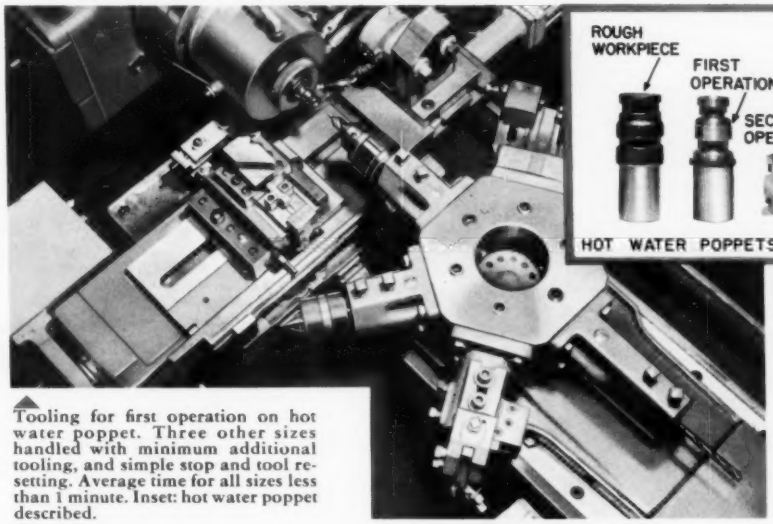
Take a look at these cast bronze hot and cold water poppets, handled with this setup at the Powers Regulator Co., Skokie, Ill., plant. A number of surfaces are automatically machined to close tolerances, using a Gisholt MASTERLINE No. 3 Ram Type Turret Lathe with independent hydraulic drive units for the turret and cross slide.

Here's how a typical 2⅜"-long, ¾"-diameter hot water poppet is handled in two fast operations. Each casting has a chucking lug turned to size, with the end faced for location against a stop within an outside, air-operated collet chuck. Hexagon turret tools center-drill the end. Then a live center supports as the O.D. contour is formed from the rear of the cross slide. Next, the O.D. edge is chamfered and the piece is rough- and finish-drilled. Two tools in a special holder on the last hex turret station size two diameters on the O.D. A special, cam-operated front cross-slide tool generates two angular seating surfaces on the O.D. within .0003" to complete the operation in only 47 seconds f.t.f.

For the second operation on the opposite end, the part is held on the machined O.D. in the same collet chuck, and located against the same stop. Front cross-slide tooling isn't used, but remains in place. The chucking lug is faced off from the rear of the cross slide. Except for different size drills and minor cutter adjustments, the same tooling setup is used to center-drill, rough- and finish-drill, and chamfer the O.D. and I.D. edges to complete the part in only 38 seconds f.t.f. time.

Automatic cycle cuts time, assures correct speeds and feeds on all surfaces, for increased accuracy, uniform quality, longer tool life. Operator simply loads...unloads ...and initiates cycle.

Ask for new Catalog 1182-A on Ram Type Turret Lathes with hydraulic drive.



Tooling for first operation on hot water poppet. Three other sizes handled with minimum additional tooling, and simple stop and tool resetting. Average time for all sizes less than 1 minute. Inset: hot water poppet described.

MACHINES WITH NEW MACHINE GUARANTEE

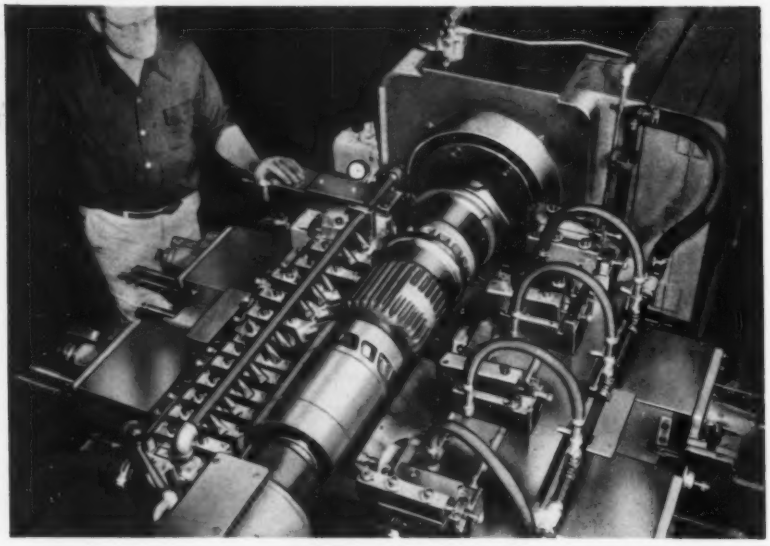
MASTERLINE GISHOLT SINCE 1887

HOW FAIRBANKS-MORSE CUT TIME 27% ON LINERS

Tandem tool slides handle 16 surfaces in one chucking

Machining multiple surfaces on long workpieces? Interested in maintaining concentricity and parallelism by completing all work in one handling? Then this setup on the Gisholt MASTERLINE No. 24 Automatic Production Lathe will interest you.

Here is how the Fairbanks, Morse & Co. plant at Beloit, Wis., is handling O.D. machining operations on one type of diesel cylinder liner. The 42½"-long, 9"-diameter parts are loaded on an air-operated, pin-type expanding mandrel. A retractable stop permits longitudinal location in one of the liner ports. A heavy-duty tailstock, mounted on an independent slide, is traversed in to the center line to provide support at the end of the mandrel.

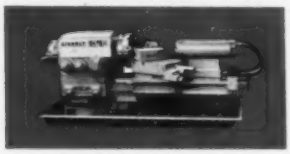


Two independent tool slides, linked together to operate as a unit, are mounted on extra wide front and rear carriages. After the part is chucked, the front slides feed to depth and then the carriage feeds longitudinally as 13 tools rough-turn ten different diameters. Three tools split up each of the two longest cuts to reduce machining time. Two diameters, closest to the spindle, are handled by one tool on a cam-operated sliding tool holder. At the same time, six tools on the rear carriage slides feed in to face both ends, face two shoulders and form two radii.

After machining, the operator retracts the tailstock quill and its supporting slide moves the tailstock away from center, clearing the mandrel for unloading. F.t.f. time: 6 min.

Tools and stops are quickly reset for a similar finishing operation on these parts.

Multiple surfaces on large parts are more easily handled on rugged No. 24. Basic design offers more tooling flexibility and automatic cycle frees operator for other work.



◀ Rear overhead view showing 42½"-long, 9"-diameter cylinder liner on tailstock-supported mandrel. 50 h.p. main drive motor provides ample power for machining loads imposed by 19 separate tools.

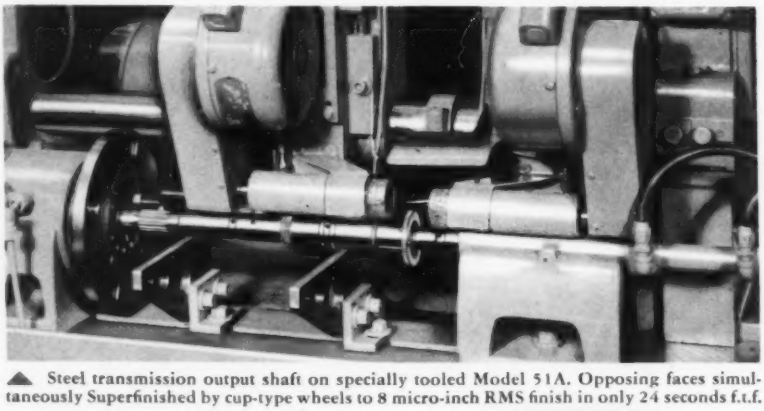
2-IN-1 OPERATION FINISHES FLAT SURFACES FASTER

Two opposing faces Superfinished at the same time

Relatively low-cost special tooling is used on this Model 51A General-Purpose Superfinisher, to permit Superfinishing opposing faces on steel transmission output shafts at high production rates. The workpieces are held between centers and driven from the splined end. Simple, adjustable loading rails speed work handling.

Here's the operation in a nutshell: After loading, the operator presses the cycle start button and two rotating Superfinish quills, carrying cup-type wheels, engage the opposing thrust and seal faces. Each wheel removes .0003" to .0004" stock to clean up all surface defects resulting from grinding and heat-treat. In addition, the 30-40 micro-inch ground surfaces are reduced to 8 micro-inches RMS. Total f. t. f. time: 24 seconds.

Both the 51A and the larger capacity 52A General-Purpose Superfinishers are easily adapted to jobs like this. There is ample space for rigidly mounting special units on the overhead support and traverse bars. Setup is fast for either small lots or long production runs. Because the Superfinishing cycle is automatic, the operator has time to handle another unit or perform other work.



▲ Steel transmission output shaft on specially tooled Model 51A. Opposing faces simultaneously Superfinished by cup-type wheels to 8 micro-inch RMS finish in only 24 seconds f.t.f.

Superfinishing opposing faces in one fast operation saves time, improves accuracy. Also provides finer finish as grinding and heat-treat defects are removed, exposing true base metal for longer service life.

Ask for new Superfinisher Catalog 1169-B.

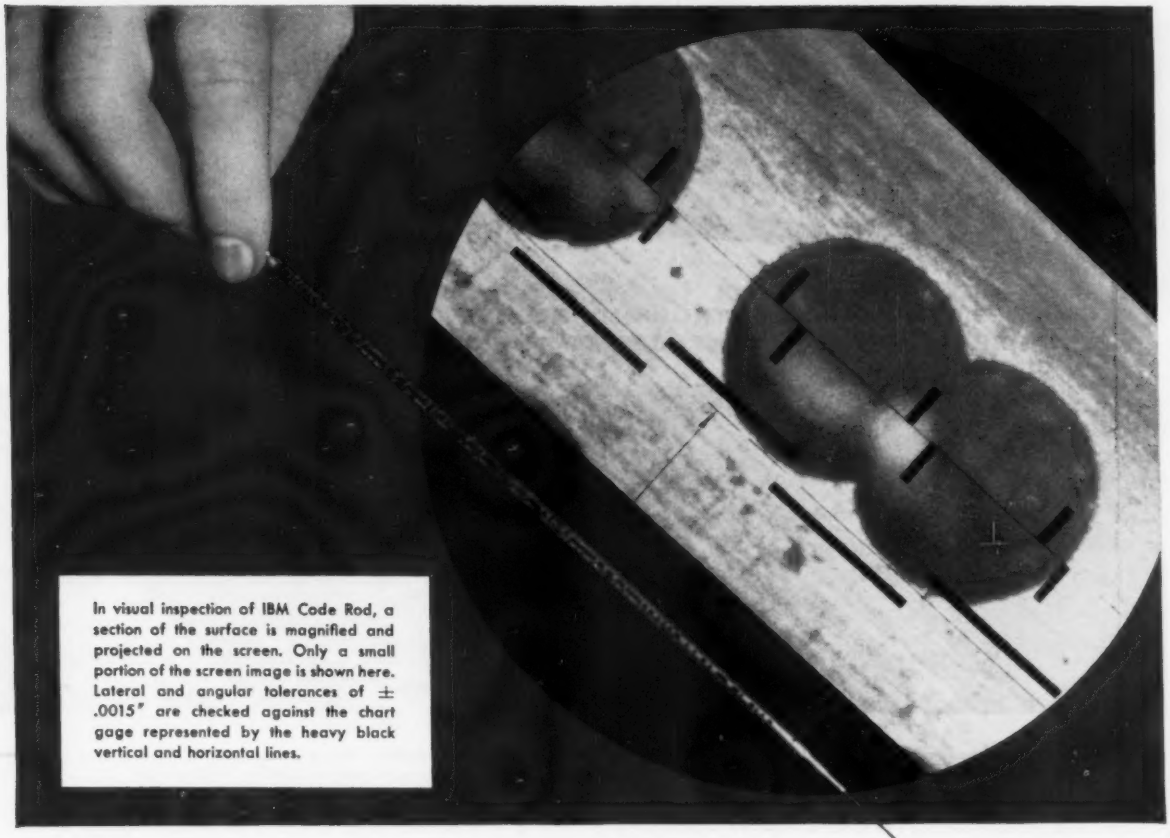
No. 3-458
701

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



In visual inspection of IBM Code Rod, a section of the surface is magnified and projected on the screen. Only a small portion of the screen image is shown here. Lateral and angular tolerances of ± .0015" are checked against the chart gage represented by the heavy black vertical and horizontal lines.

How would you gage these 1,118 holes?

Here's how IBM did it... and smashed an inspection bottleneck

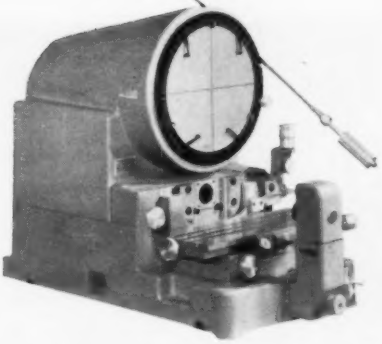
Here's how International Business Machines Corporation boosted the inspection rate on its new Code Rod from 1 or 2 *per day* to 15-20 *per shift*—keeping pace with production, yet maintaining complete accuracy—with a Kodak Contour Projector, Model 14-2A.

The Code Rod is used with the new 720 High Speed Wire Printer, developed by IBM to overcome the speed limitations of conventional bar type printers. The rod is a stainless steel tube with no less than 1,118 1/32" holes. The holes are drilled in various combinations at 7 different intervals in 7 straight rows down the 8" length of the tube. Obviously the inspection problem is of no small proportions.

Lateral and angular tolerances for the holes are ± .0015". *To maintain these tolerances is critical because any mis-drilled holes would cause an error in the shape of the characters to be printed.* What's more, the 720 Printer operates at extremely high speeds, and any slight error could affect its operation.

In visual inspection a master Code Rod is placed next to the rod to be inspected. Both surface images are projected on the screen. The operator simply indexes the image along simultaneously, so that he always has a correct rod in view for comparison of the hole grouping. He checks tolerances by a chart gage on the projector screen.

Got an inspection bottleneck at your plant? Optical gaging with a Kodak Contour Projector may well be the answer. The booklet "Kodak Contour Projectors" gives examples of how other firms are profitably using Kodak Contour Projectors, plus full data on the various models we offer. The booklet is available on request from:



Kodak Contour Projector, Model 14-2A, is a versatile precision measuring instrument for production lines or toolroom. It is one of 6 Kodak Contour Projector models available to meet all your optical gaging needs. Operators work in complete comfort, need little training.

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak TRADE MARK

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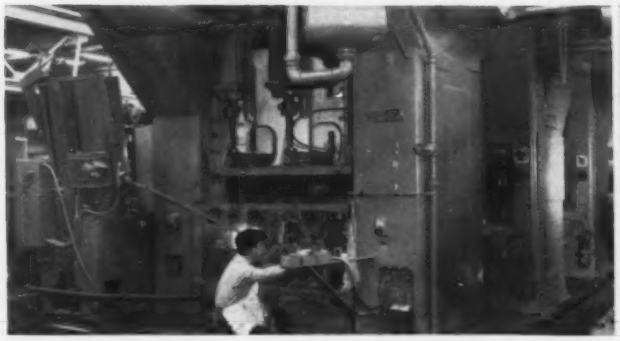
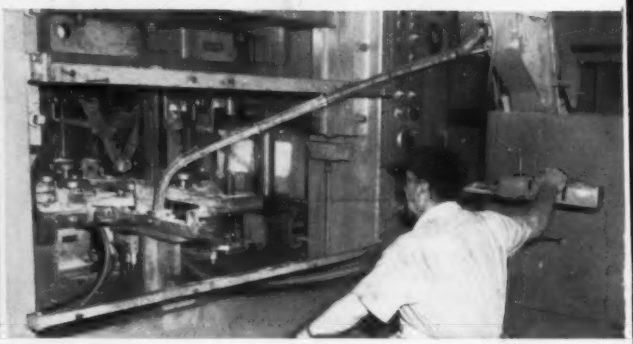
TRADE Verson MARK

COLD

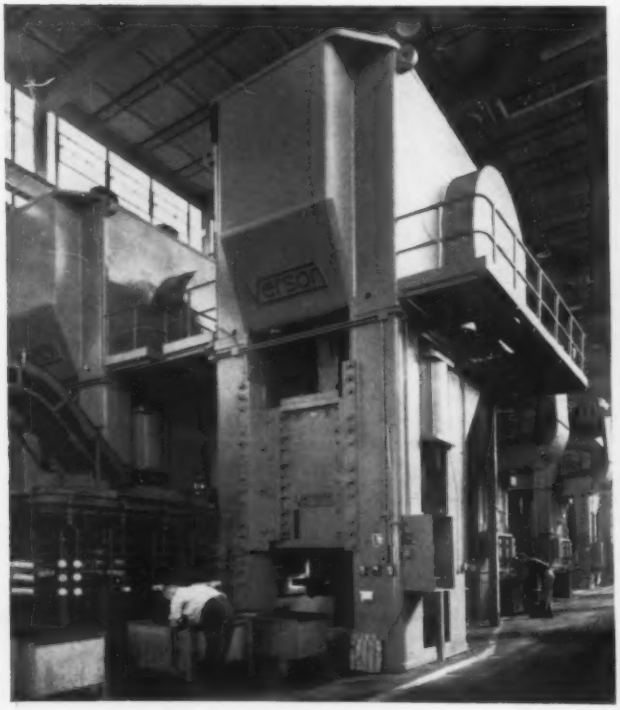
THESE VERSON EXTRUSION PRESSES ARE PROVING DAILY THE ECONOMICAL ADVANTAGES OF THE COLD EXTRUSION PROCESS



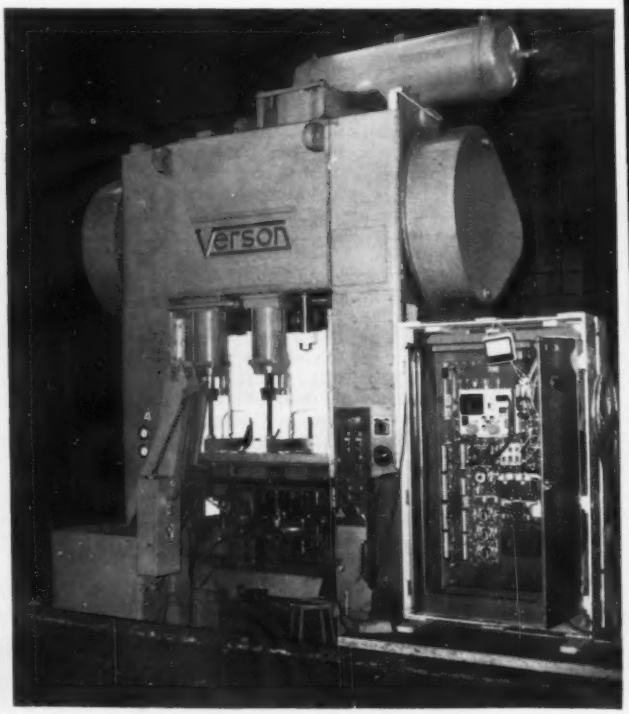


Above is a line of three identical 400 ton Verson extrusion presses producing the automotive valve tappet shown on the facing page. A close-up of the die space is shown at the right. All three presses are complete with cushion equipment, automatic feeds and dial type tooling. Each press operates at 30 SPM and produces two parts per stroke.

A pioneer installation of two Verson extrusion presses rated at 1500 and 4500 tons respectively.



Successful operation on Verson extrusion presses in your plant is assured by tryout on production runs before shipment.



EXTRUSION...

it may be your best opportunity for improving your profit spread

In the intensive search for ways to hold materials and manufacturing costs down, cold extrusion has emerged as a major weapon. Scores of piece parts that formerly had to be machined from bar stock or hot forged, can now be extruded at a fraction of their previous cost. Scrap loss and the amount of machining necessary has been slashed.

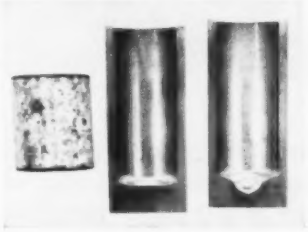
This is no longer a theoretical concept. Verson cold extrusion lines have been in production for as long as three years. Since 1955 Verson has conducted a comprehensive Cold Extrusion Research and Development Center in its Chicago plant for the purpose of developing and proving tooling and lubrication techniques.

Out of this experience has come the cold extrusion know-how necessary to evaluate the adaptability of the process to your production requirements. With the ever-tightening squeeze on your profit margin, you can't afford *not* to investigate the cost-cutting possibilities of Verson Cold Extrusion. Get in touch with Verson, today. For recommendations, send an outline of your needs.

A special report on Tooling for Cold Extrusion will give you a better insight into what can be done with cold extrusion. Write for your copy; there's no obligation.

VERSON COLD EXTRUSION CAN REDUCE MATERIAL COSTS, CUT MACHINING COSTS ON JOBS LIKE THESE

Shown here in both exterior and cross section views is a propeller shaft end for an automotive drive shaft. It is made from AISI 1037 steel in two operations in 600 ton Verson extrusion presses. The part is 3 3/16" in finished length and is produced at a rate of approximately 1200 per hour.



This is the automotive tappet produced in the presses shown at the upper left on the facing page. Shown are the slug and cross sections after first and second operations. After heat treating, finish grinding and drilling of an oil hole, the part is ready for installation.

This is a universal joint bearing race made in one operation on a 400 ton Verson extrusion press. The press operates at 30 strokes per minute, producing two of the 1 1/16" x 9/16" parts per stroke from AISI-1018 steel.

A Verson Press for every job from 60 tons up

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

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BETTER CARS ARE BEING BUILT

New

Henry & Wright Double-Crank Dieing Machines Produce More Parts Faster . . . More Accurately

150 ton Henry & Wright, one of ten installed by a leading automobile manufacturer in the Flint area.

Die operations on a hood bumper bracket. After the neck of the part has been freed, the work is advanced by a single tab and a carrier strip.

Stamped parts of today's cars must be produced rapidly and in quantity, but they must also be held to close tolerances of accuracy. Henry & Wright machines are now offered in a new double-crank design. The crosshead is supported on both sides of the die so that the tools close in perfect alignment even with severe off-center loads. Thus, parts are more accurate and uniform . . . die life is greatly extended. Because machine design permits quick and easy die change, non-productive time is reduced to a minimum.

Handling more jobs—faster—and to required accuracy tolerances—makes the H & W machines an integral part of automation processes for any plant. These machines are truly the result of "pooled ideas" from the automotive field and from experienced H & W engineers.

Send today, for complete information on these new and proven production profit makers. Build your new production around Henry & Wrights—they're made by H-P-M, you know, a leader in metalworking processes since 1877.

H-804

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U.S.A.

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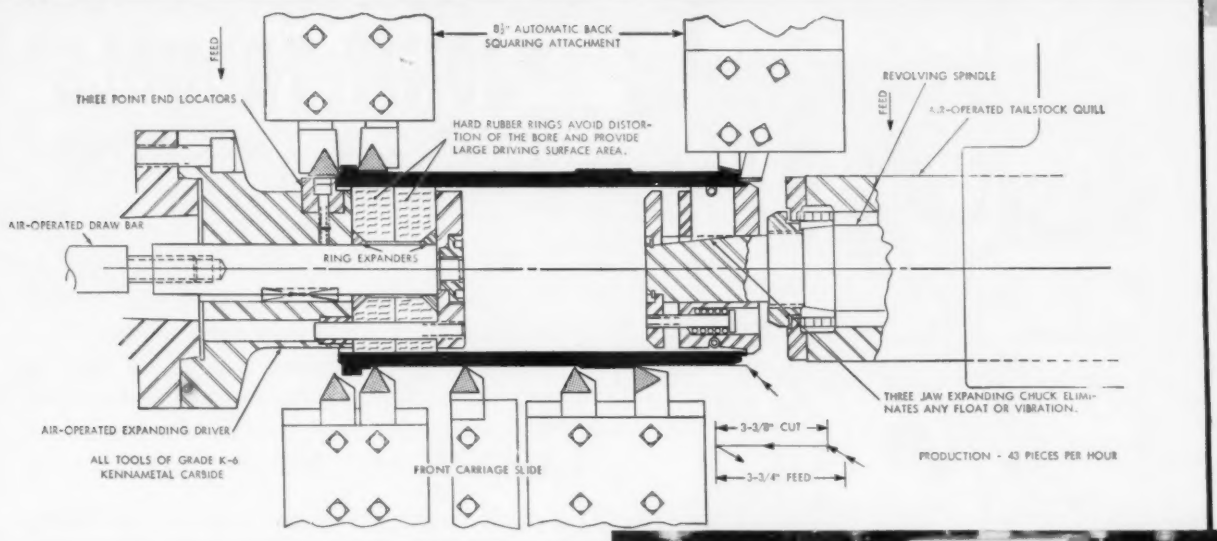
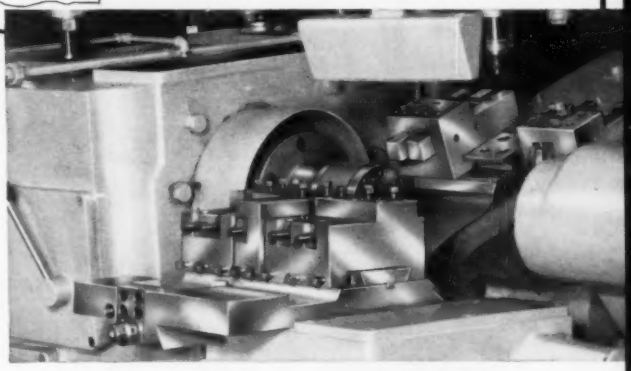
CYLINDER LINERS MACHINED ECONOMICALLY ON Lo-swing LATHES


FEED
THREE POINT END LOCATORS
8½" AUTOMATIC BACK SQUARING ATTACHMENT
HARD RUBBER RINGS AVOID DISTORTION OF THE BORE AND PROVIDE LARGE DRIVING SURFACE AREA.
REVOLVING SPINDLE
FEED
AIR-OPERATED TAILSTOCK QUILL
AIR-OPERATED DRAW BAR
RING EXPANDERS
THREE JAW EXPANDING CHUCK ELIMINATES ANY FLOAT OR VIBRATION.
AIR-OPERATED EXPANDING DRIVER
ALL TOOLS OF GRADE K-6 KENNAMETAL CARBIDE
FRONT CARRIAGE SLIDE
3-3/8" CUT
3-3/4" FEED
PRODUCTION - 43 PIECES PER HOUR

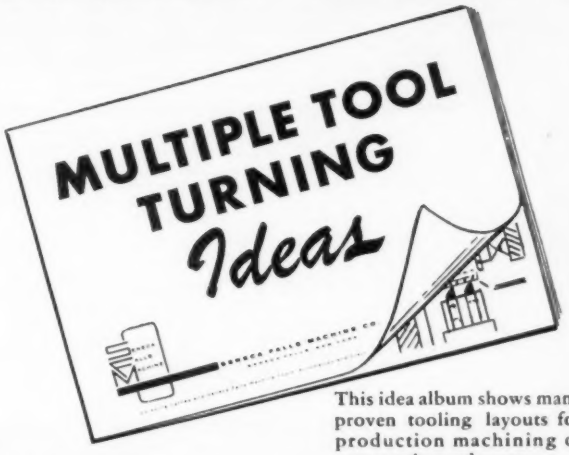


PROBLEM: To turn... without distortion... as well as face and chamfer, various cast, thin wall Diesel Cylinder Liners.

SOLUTION: The Model AR Automatic Lo-swing Lathe was selected for this job as it has: (1) *Necessary rigidity* for utilizing carbide tools. (2) *Simplified Change-Over Mechanism,* permitting all cams to be pre-set to graduated dials for length of cut. (3) *Instantaneous Tool Relief Control Mechanism,* which permits reversing carriage and slide feed movements without disturbing timing of slides or adjustment of the tools.

The Cylinder Liners are driven on the headstock end with a special driver which permits high cutting speeds and coarse carriage feeds without distortion. The tailstock end of the liner is supported with an expanding chuck operating under controlled air pressure to prevent distortion. All turning, facing and chamfering operations are performed simultaneously. The entire cycle is automatic; the operator simply loads and unloads the parts and pushes the starting button.

PRODUCTION!!! 43 pieces per hour at 100% efficiency. Seneca Falls engineers find solutions for the most difficult turning problems and are at your service.



This idea album shows many proven tooling layouts for production machining of commonly used parts.

SENECA FALLS MACHINE
ENGINEERED FOR PROFIT

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SENECA FALLS MACHINE CO.

SENECA FALLS, NEW YORK

Lo-swing Lathes and Seneca Falls Machine Tools, Automation and Electronics

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"JOINT TROUBLE"

IS U. S. DRILL HEADS!

This is no "medicine man" talk! U. S. Universal Joint Heads have greater reserve stamina than you'll ever need! Heavy-duty joints are specially heat treated for greater capacity than rated . . . drivers and spindles have more than ample bearing . . . shaved gears insure smooth, quiet, full-power performance.

Get profit-making universal joint adjustability with U S. Drill Heads. Less downtime, quicker changeover, positive hole positioning. And, for long production runs, Slip Spindle Plates provide the advantages of fixed center heads.

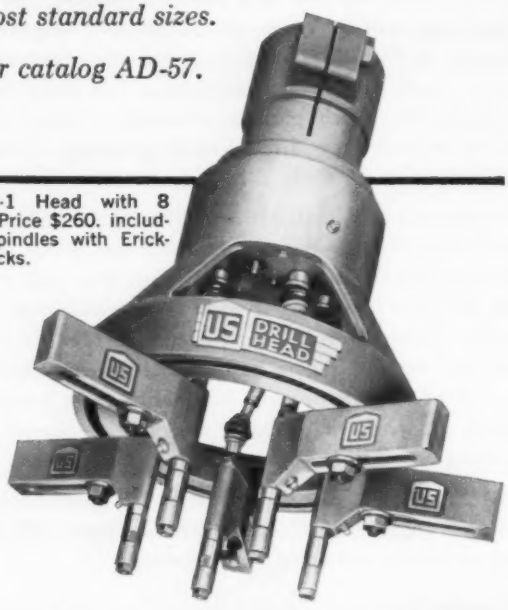
Immediate delivery on most standard sizes.

Write for catalog AD-57.

Only U. S. Drill Head provides a FULL RANGE of **standard** Universal Joint Adjustable Heads

Style Head	No. of Drivers	Drilling Capacity	Drilling Area (Dia.)
U-1	8	¼"	6"
U-1L	8	¼"	8"
U-1½	6	½" or ¾"	6"
U-2	10 or 12	½" ¾"	10" 9¾"
U-3	10 or 12	15/32" to ⅞"	12"
U-4	12	15/32" to 1-1/16"	15"

Style U-1 Head with 8 drivers. Price $260. including 2 spindles with Erickson chucks.



US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

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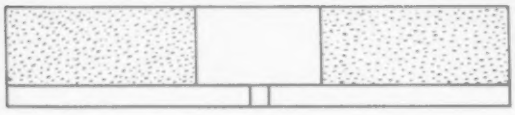
Change to Gardner abrasive increases production per disc 500%

Increase from 55,000 to 300,000 parts per disc... with lower unit grinding cost... due to longer disc life

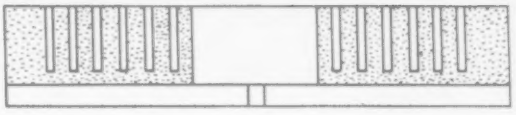
Disc—30″ diameter
2″ thickness
8″ center
24″ diameter of deep corrugations

Former type disc



In flat surfacing operation grinding cast iron flanges, the disc in use required frequent replacement. Longer disc life was sought. The Gardner Abrasives Specialist was called in to study the problem.

Gardner type disc



A Gardner combination disc was recommended with smooth outside surface and deep corrugations inside. It withstands heavy stock removal, runs cooler, lasts over five times longer.

GARDNER
abrasive discs
BELOIT, WISCONSIN

WASHINGTON IRVING HAS NOTHING ON US!*

*Ichabod Crane and his Legend of Sleepy Hollow, originators of the throw-away head!

T-J Reamers

have throw-away heads, too!

New Exclusive Design Cuts Replacement Costs More Than Half!

Exclusive in design . . . the New-type T-J Reamers cut your replacement costs *more than half!* Only the quickly installed *head* to replace, after buying original shank. Wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments are available with right or left hand spiral flutes for thru or blind hole reaming.

Tapered hole in head insures concentricity and *new* thread design assures a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking due to cutting portion wearing undersize and creating negative relief. Backed by T-J's 40 years of know-how as one of the largest manufacturers of die sinking milling cutters. Write to Tomkins-Johnson Co., 617 North Mechanic Street, Jackson, Michigan for T-J Catalog #153-1.

SEE US AT BOOTH 1423
A. S. T. E. SHOW

TOMKINS-JOHNSON CO., Jackson, Mich.

T-J **TOMKINS-JOHNSON**
RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHERS

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ARROW PROFILER SWARF

mills from -20° to +20° in steel!

The Arrow Profiler with swarf attachment machines swarf or twist cuts 20° either side of vertical —simultaneous with two or three-dimensional contouring. You can mill *steel*, as well as aluminum, magnesium and titanium, with swarf angle tolerance held to ± *1 minute*.

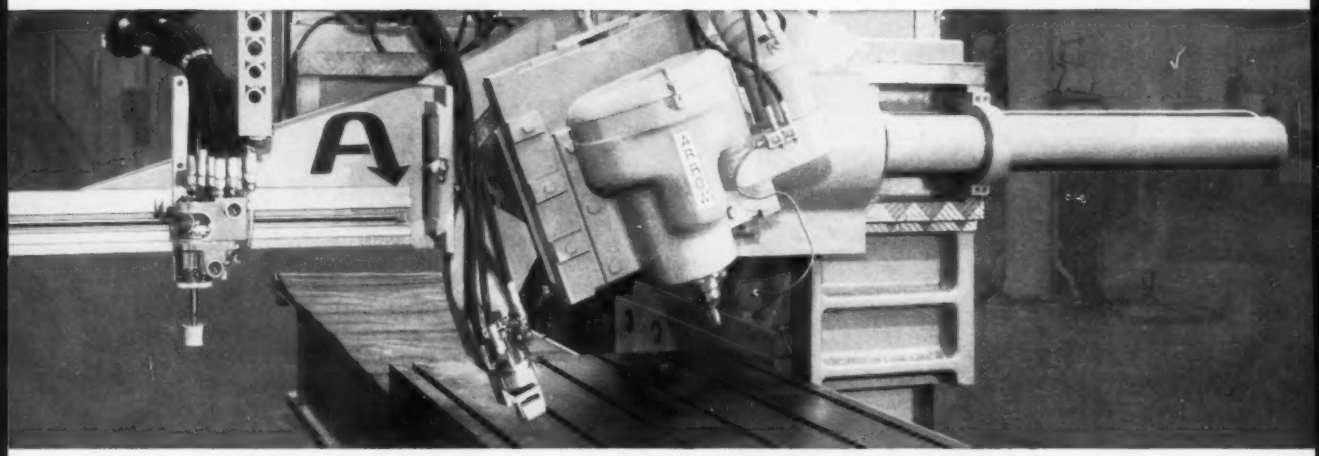
A separate 180° valve operating on its own rise and fall template actuates the swarf. This valve is mounted directly on the swarf head; no accuracy-stealing linkage to "give" or wear out. Contour is controlled by the regular tracing valve, with stylus manually operated against the two or three-dimensional template.

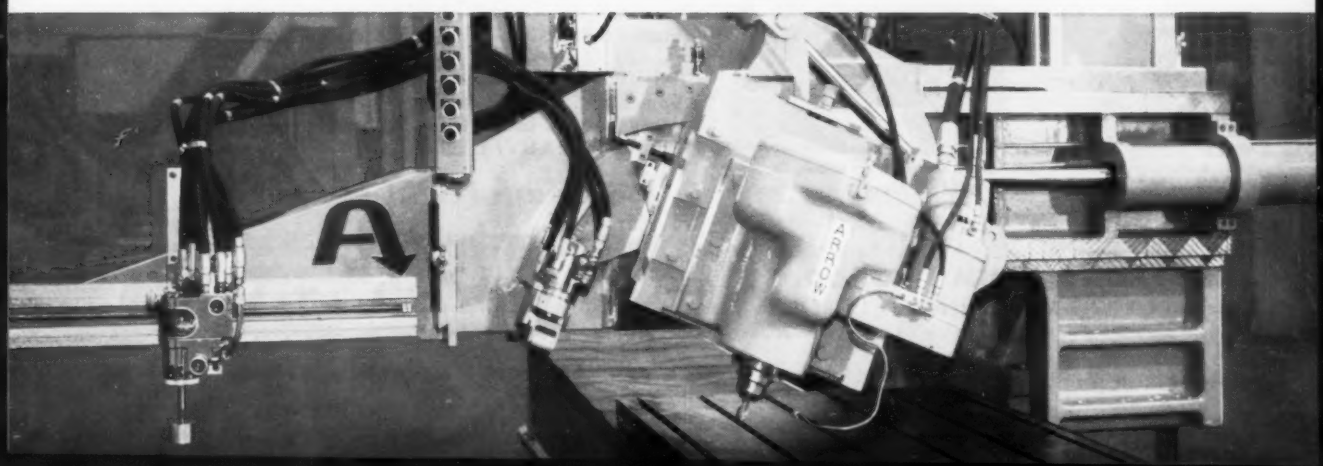
The Arrow Profiler, with its 40 hp hydraulic spindle, cuts steel up to limits of cutters. 25 speeds from 37 to 3000 rpm. Table is 42″ x 144″, with 136″ travel. It is easy to operate, accurate and versatile. And it costs less than any comparable machine.

There's a reason for Arrow's low cost—simplicity. No frills. Just the basic machine you need, without little-used gadgets and accessories. Plus a simple *manual* concept of operation.

Write today for Bulletin PR-156M for a complete description of the Arrow Profiler and Swarf Attachment.

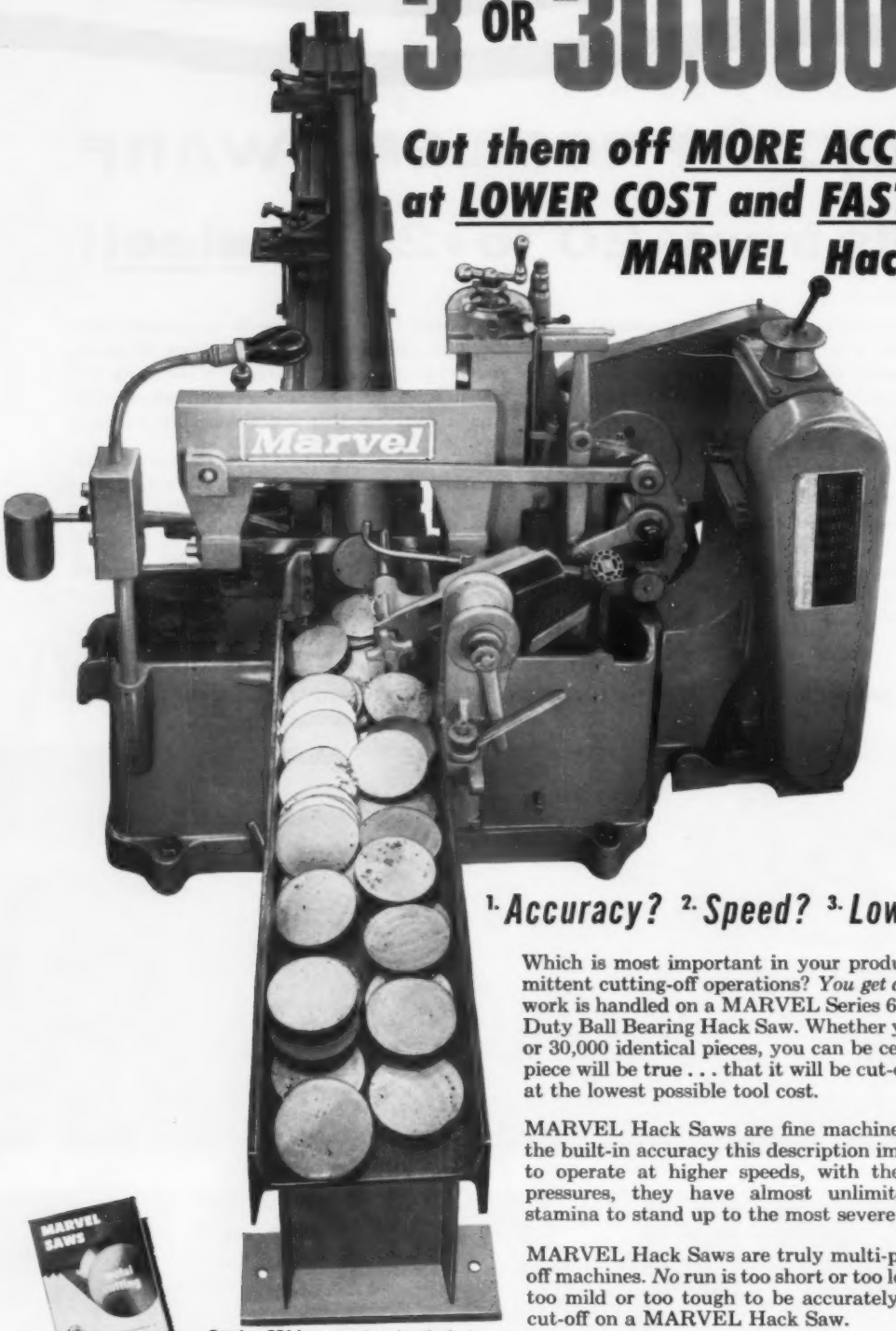
ARROW ENGINEERING COMPANY, INC. *1523 Oliver Avenue, Indianapolis 21, Indiana*





3 OR 30,000 PIECES

Cut them off MORE ACCURATELY at LOWER COST and FASTER on a MARVEL Hack Saw



1. Accuracy? 2. Speed? 3. Low Cost?

Which is most important in your production or intermittent cutting-off operations? *You get all 3* when your work is handled on a MARVEL Series 6A or 9A Heavy Duty Ball Bearing Hack Saw. Whether you're cutting 3 or 30,000 identical pieces, you can be certain that each piece will be true . . . that it will be cut-off quickly, and at the lowest possible tool cost.

MARVEL Hack Saws are fine machine tools, with all the built-in accuracy this description implies. Designed to operate at higher speeds, with the heaviest feed pressures, they have almost unlimited power and stamina to stand up to the most severe service.

MARVEL Hack Saws are truly multi-purpose cutting-off machines. *No* run is too short or too long, *no* material too mild or too tough to be accurately and efficiently cut-off on a MARVEL Hack Saw.

Catalog C56 has complete details, facts and figures on MARVEL Metal Cutting Saws. Write for it today.

S-1306

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

MARVEL Metal Cutting SAWS
Better Machines–Better Blades

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Cracked shaft in Valdosta . . . **His job: get a new one down to Georgia by tomorrow noon.** It's an emergency case, but it's not as tough as it sounds.

He's backed by the press industry's largest parts department . . . by a million dollar parts inventory in two plants . . . by telephone and Teletype tie-ups between Parts Headquarters in Hastings, Michigan and Toledo and local sales and service centers throughout the country.

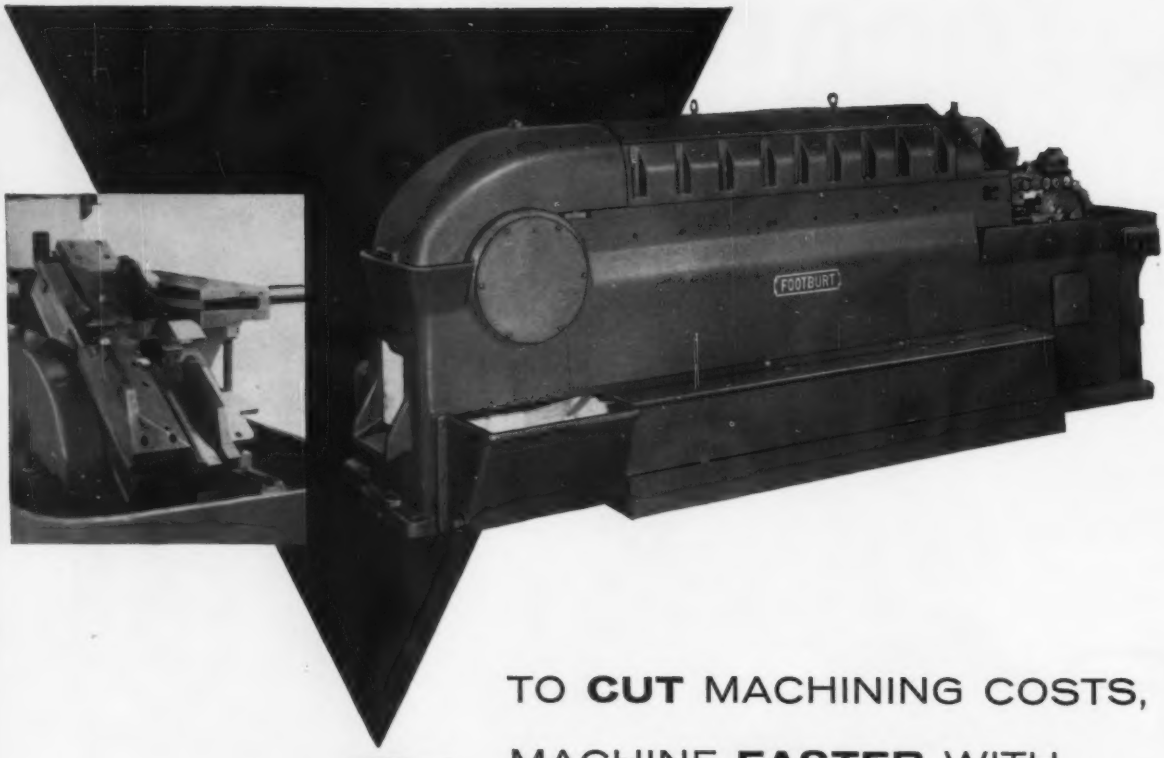
Which is another reason why we say, "Bliss is more than a name . . . it's a guarantee."

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE



TO **CUT** MACHINING COSTS,

MACHINE **FASTER** WITH

Continuous broaching

Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

THE FOOTE-BURT COMPANY

Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

Write for Circular No. 503

ENGINEERED FOR PRODUCTION

FOOTBURT

PIONEERS IN SURFACE BROACHING

a Plug*...

FOR
ACCURACY...
ECONOMY...
RIGIDITY!

* **STANDARD'S**
EXPANDABLE CARBIDE TIPPED REAMER

The STANDARD Line:—
Twist Drills
Reamers
Taps . . . Dies
Milling Cutters
End Mills . . .
Counterbores
Carbide Tools
Gages
Hobs

For High Production, Precision Reaming . . . consider STANDARD'S Patented Carbide Tipped Expansion Reamer!

ACCURACY . . . Uniform expansion of all cutting edges. No high or low lands after expansion.

ECONOMICAL . . . Saves money . . . expansion feature offsets wear. Saves Time . . . no regrinding after expanding reamer back to size.

RIGIDITY . . . of conventional reamer is maintained . . . tool body is solid not split.

The STANDARD Distributor in your area stocks a complete line of rotary metal cutting tools.

Quality Tools Since 1881

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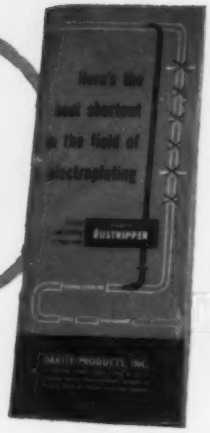
Platers find many uses for chelating *cleaner



*Chelating (pronounced key-lating) cleaners convert metallic salts and oxides into compounds soluble in water.

By chelating and removing rust or heat scale at the same time that it removes oil, Oakite Rustripper combines pickling and alkaline cleaning into one operation. It also avoids disadvantages of acid pickling, such as hydrogen embrittlement and etching of machined surfaces.

Platers now use Rustripper for dozens of difficult steel-cleaning jobs. Here are some examples reported in recent weeks:

CALIFORNIA: "Rustripper has ended pickling damage such as embrittlement." (Removing oil and light rust from machined landing gears before cadmium plating.)

NEW YORK: "Now saving about $10.40 per day on removing rust and scale and producing brighter plate." (Rustripper, added to reverse current cleaner in automatic plating machine, has eliminated separate pickling of wire towel racks before nickel and chrome plating.)

CONNECTICUT: "Rustripper added to reverse current cleaner has eliminated troublesome smut from metal furniture prior to copper-nickel-chrome plating."

NEW YORK: "Rustripper very good in barrels for derusting and brightening business machine parts . . . also for removing brown stains from parts put through black oxide treatment."

NEW YORK: "Small steel aircraft parts were embrittled by acid pickling. Rust, heat scale and stains are now safely removed by Rustripper and cyanide."

NEW JERSEY: "Only two cleaning rejects in first 15,000 parts plated." (After Rustripper was added to reverse current cleaner in automatic plater to eliminate smut from tubular steel furniture.)

INDIANA: "Rustripper is the best barrel compound we ever used for this job." (Removing tough heat treat scale from steel screws.) "Total cleaning and zinc plating time has been cut in half."

NEW YORK: "Had trouble with light rust on business machine parts before cadmium plating; also with smut left after electrocleaning. Rustripper cured both troubles."

FREE A 14-page illustrated booklet called *"Here's the best shortcut in the field of electroplating"* tells about many ways in which Oakite Rustripper can be of great value in the plating shop. Write to Oakite Products, Inc., 26 Rector St., New York 6, N. Y.

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85 Tons of Tie Rods

Though they might remind you of big gun barrels, these massive forgings are tie rods for a 6500-ton hydraulic press constructed by Lake Erie Machinery Corporation, Buffalo, N. Y. Each of the rods is about 36 ft long; the combined weight of all four is slightly under 85 tons.

These pieces were forged, normalized, tempered, and finish-machined in the Bethlehem shops. Machining included threading at both ends. All in all, it was quite an assignment, one requiring a high degree of precision, for the rods had to be identical. No deviation from specifications could be permitted.

Bethlehem makes heavy forgings in an almost endless variety. But please remember, when thinking of Bethlehem, that smaller forgings have their innings, too. Some of the items produced in our drop-forge shops could be carried in your pocket.

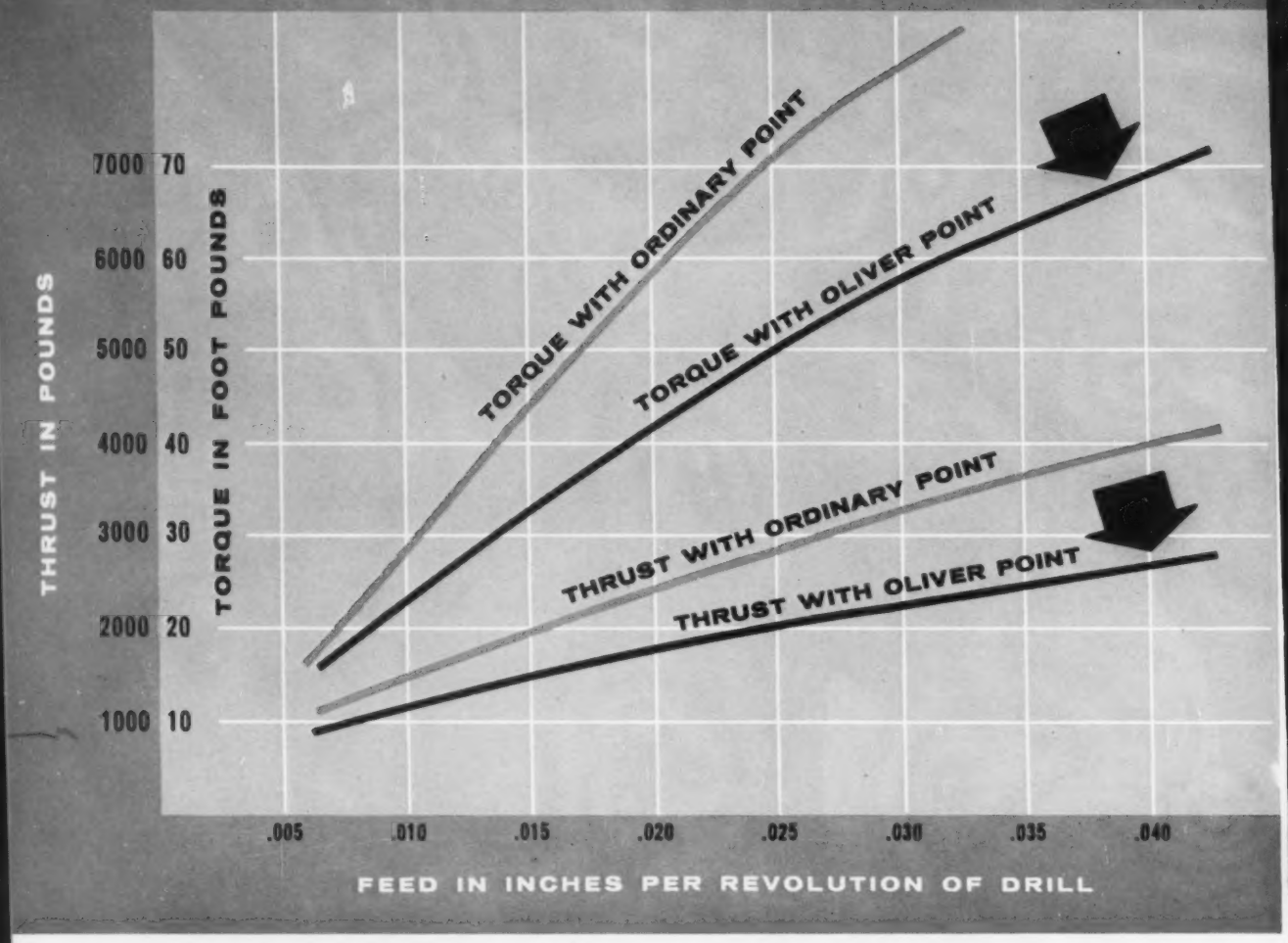
We suggest that you check with our engineers when next in the market for either large or small forgings. Press, hammer, drop, or upsetter—Bethlehem makes them all. And you can be sure that our prices and deliveries are fully competitive. Just phone or write our nearest sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

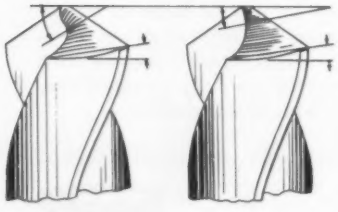


CURVES SHOWING EFFECT OF VARYING FEEDS, TORQUE and THRUST—1″ DRILL IN C. R. S.

OLIVER DRILL POINTER

PROOF!

OLIVER helps you get *more holes per grind!*

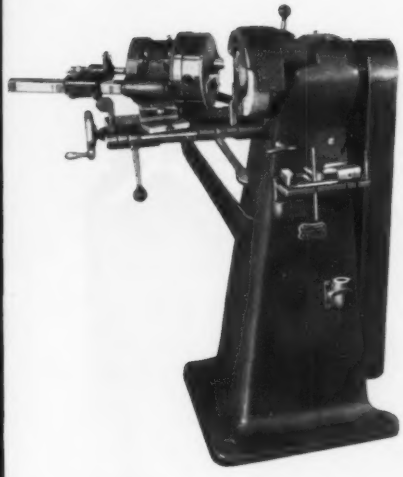


The drill point on the right is one as ordinarily ground. On the left is an exaggerated view of an Oliver drill point. Note that the clearance angle on the point increases very rapidly as the drill web is approached.

Substantially less torque—much less thrust!

The above graph is the result of tests run by the research department of an eastern engineering school. It is evidence that Oliver can help you get more and better holes per grind.

Oliver's sharpening principle is to grind the drill point so that increased clearance is obtained at the center of the drill. The cut is balanced with each lip doing its equal share and the theoretically perfect point permits easier penetration. A drill sharpened this way has the stamina to deliver more holes before resharpening. Less feeding pressure means savings on drilling machine repairs, power and transmission costs and the drills themselves.



OLIVER

510 DRILL POINTER

Operation is semi automatic . . . covers the entire range of drill sizes from ¼" to 3" diameters . . . grinds two-, three- and four-flute drills and all point angles from 82° to 160° included. The form of the point is controlled by a master cam which may be varied to produce the proper clearance for the material being drilled.

OLIVER

21 DRILL POINTER

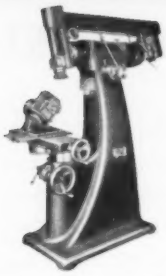
. . . a precision machine for small drills and built to machine tool standards. Drills are located in a jig before grinding for positive set-up. A definite setting produces the desired grind each time—accurately and uniformly. The machine may be mounted on a bench or a pedestal.

OLIVER

DRILL POINT THINNER

. . . designed for conventional point thinning and other work such as deep hole drill thinning, notching, chip breaking, clearing out flute and many other thinning operations. The machine is completely universal, easy to set up and operate. It is a natural companion to the 510 drill pointer.

More **OLIVER** *of* **ADRIAN** *Tool Grinding Equipment*

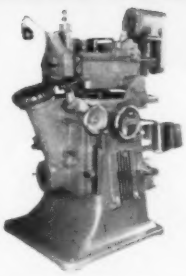


"ACE" TOOL-CUTTER GRINDER

Universal—grinds wide range of milling cutters and other cutting tools. Especially suited to grinding tungsten carbide.

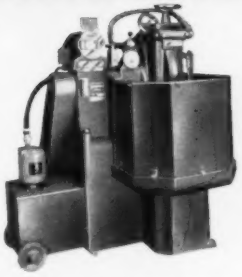
DIE MAKING MACHINE

Built to produce dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. Five designs in two types.



FACE MILL GRINDER

The only completely automatic grinder on the market. A machine tool designed for accurate grinding.



TEMPLATE TOOL BIT GRINDER

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.

Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .

OLIVER of **ADRIAN**

OLIVER INSTRUMENT COMPANY

1410 E. Maumee St. • Adrian, Michigan

- ☐ Drill Pointer
- ☐ Face Mill Grinder
- ☐ "Ace" Universal Tool and Cutter Grinder
- ☐ Literature only
- ☐ Die Making Machine
- ☐ Drill Point Thinner
- ☐ Template Tool Bit Grinder
- ☐ Quotation requested

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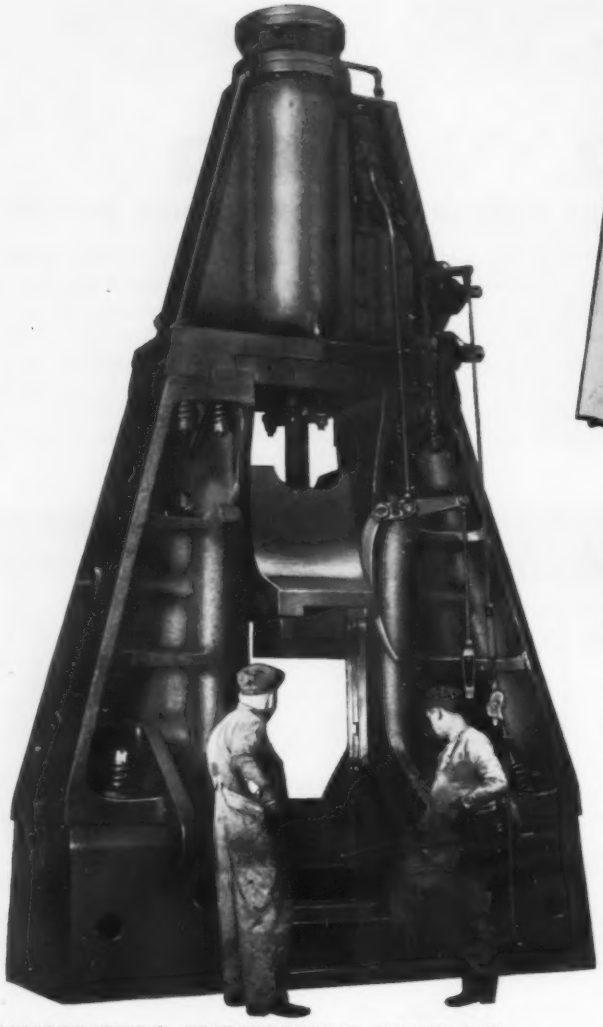
Do your Steam Hammers look like this?

TIME TO MODERNIZE



CHAMBERSBURG STEAM DROP HAMMERS

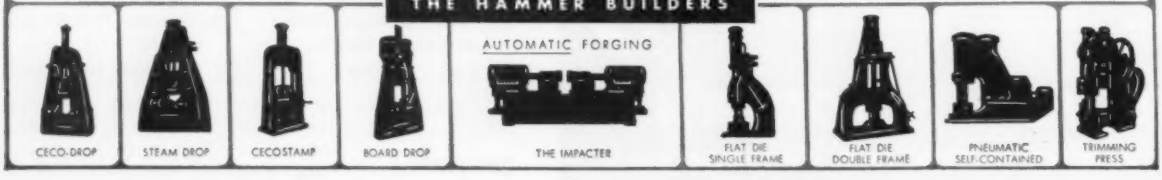
have kept pace with modern forge shop requirements. With Chambersburg Steam Drop Hammers you get more forging per blow and more forgings per hour for higher production. And—at the same time you'll find production savings in lower power consumption, less downtime, better die alignment. Every feature of Chambersburg Hammers is designed to produce forgings at the lowest possible cost per piece.

Write for Bulletin

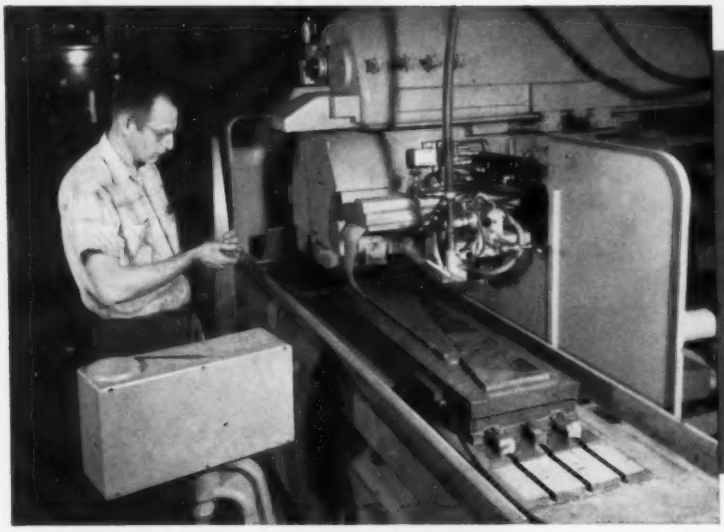
CHAMBERSBURG ENGINEERING COMPANY . . . . . CHAMBERSBURG, PA.

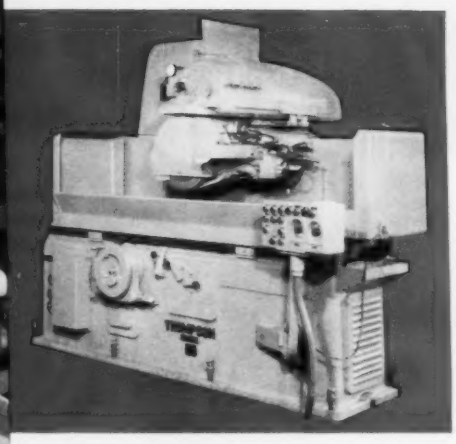
CHAMBERSBURG

THE HAMMER BUILDERS



THE NEW THOMPSON PLUNGE-MATIC SURFACE GRINDER





COMPLETELY AUTOMATIC

With the new Plunge-Matic, Thompson now offers a plunge feed machine for those surface grinding jobs where the area to be ground is constantly covered by the grinding wheel width. Designed for fast production, the Plunge-Matic is completely automatic—including downfeed, wheel dressing and automatic compensation.

Shown above is one of four Plunge-Matics in use at the Disston Division, H. K. Porter Company, Inc., grinding high quality hand saws. The saws are held on tapered flux bars or magnetic shims and the wheel face is dressed straight with an automatic power operated wheel truing device. The four machines are equipped with a pre-selected variable downfeed arrangement which automatically decreases the downfeed rate as the contact area of the work increases. The wheel heads are also equipped with oscillating crossfeeds. Being completely automatic in their cycles, the four machines require but two operators who load and unload only.

Constant Accuracy is Assured by Hydra-Cool

All Thompson Plunge-Matics are made in various types and sizes to meet all job requirements. All machines of 40 inches and up in work length are equipped with the Hydra-Cool Hydraulic System*—the exclusive Thompson feature which eliminates all heat distortion throughout the machine.

* PAT. APPLIED FOR

The new Thompson Plunge-Matics are designed to grind contoured as well as flat surfaces with equal efficiency. The three drawings at right represent but three of many contour jobs which Thompson Plunge-Matics are now handling successfully.

Send for descriptive folder on this new Plunge-Matic surface grinder.

Thompson SURFACE GRINDERS

SPECIFICATIONS	
GRINDERS:	Thompson Type C 12"x16"x-48" Plunge-Matics
WHEELHEAD:	40 HP
WHEEL:	20"x8"x12"
STOCK REMOVAL:	Approx. .010" from each side
PRODUCTION RATE:	60 saws every 50 minutes from 2 machines with one operator

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

For more information fill in page number on Inquiry Card, on page 195

THE "BUFFALO" UNIVERSAL IRON WORKER

NOTCHES
PUNCHES
SHEARS
MITERS
SLITS CUTS COPES

takes the space of one machine, does the work of six—FAST!

The compact, multi-purpose "Buffalo" Universal Iron Worker saves space, time and work. It occupies the space of only *one* machine, yet performs up to *six* operations. The UIW will handle up to three jobs *at once,* thus saving much labor and time in conveying work.

The versatile "Buffalo" Universal Iron Worker is available in several models for cutting, punching, notching, shearing, slitting, coping, mitering—without changing tools. It quickly and easily handles angles, tees, channels, bars and flats.

The heavy electrically-welded steel plate frame, rugged construction throughout and one-shot lubrication system insure a long life of efficient, dependable service. Easy to set-up, easy to operate, the "Buffalo" Universal Iron Worker will speed up production and maintenance in your shop as it has in hundreds of others.

Contact your "Buffalo" machine tool dealer for a demonstration of the UIW—see how it can streamline *your* shop operations. Or, write for Bulletin 360-G for full details.

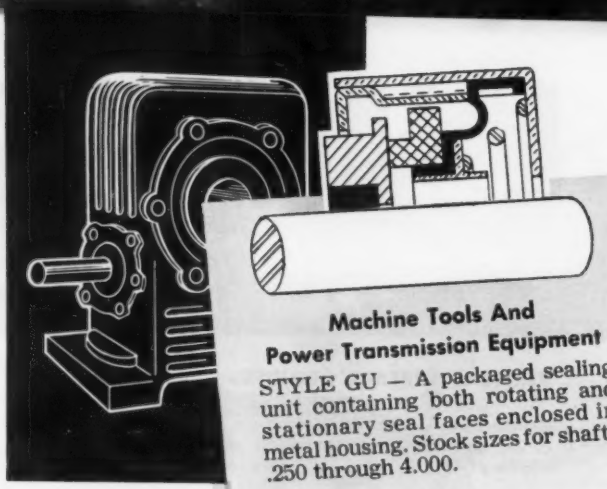
Every "Buffalo" product brings you the extra "Q" Factor value-bonus—the built-in QUALITY that provides trouble-free satisfaction and long life.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY
440 BROADWAY • BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

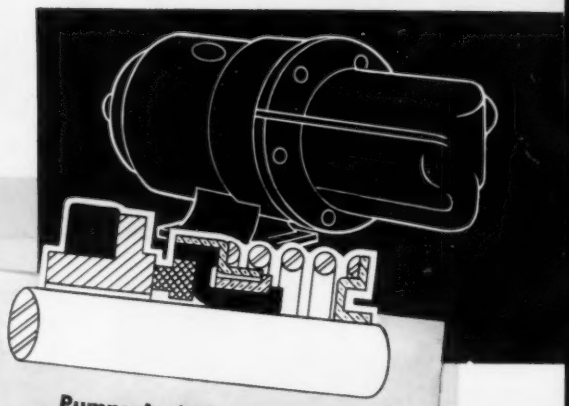
DRILLING
PUNCHING
SHEARING
BENDING

For more information fill in page number on Inquiry Card, on page 195



Machine Tools And Power Transmission Equipment

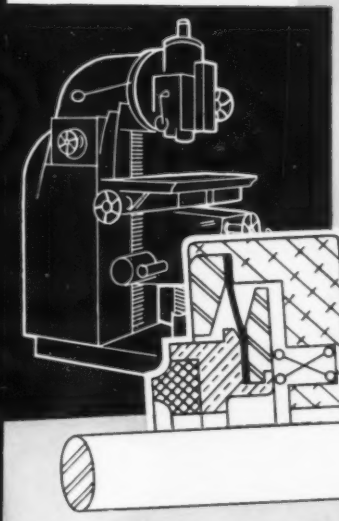
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

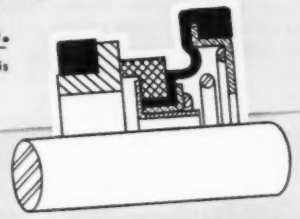
A Complete Line
GITS SHAFT SEALS
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

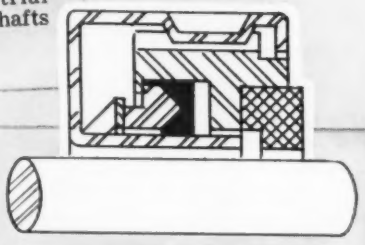
1858 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



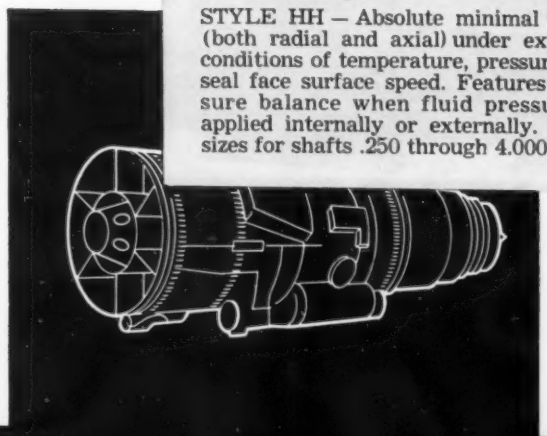
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

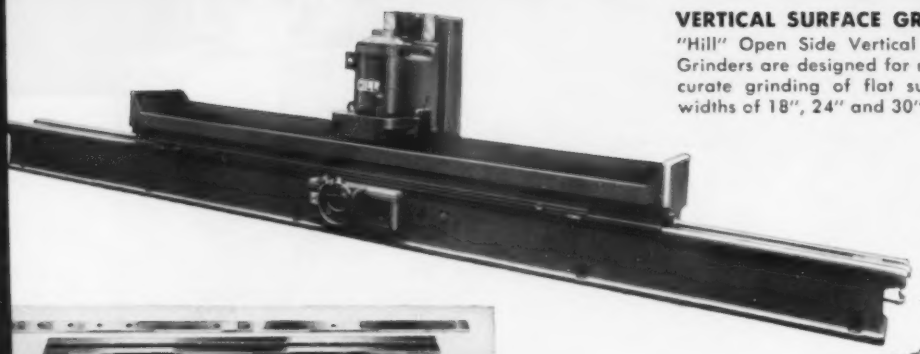
STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



See us at the Design Engineering Show, Chicago Amphitheater, Booth 838

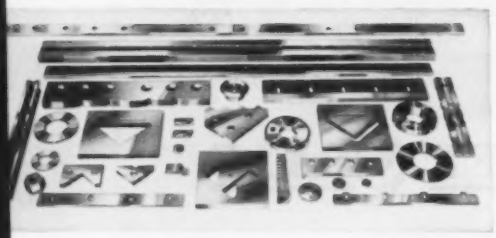
HILL ACME

HILL ACME TOOLS FOR INDUSTRY



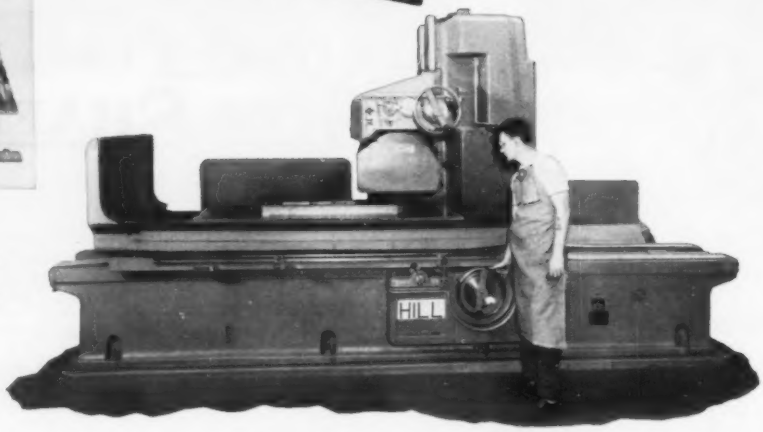
VERTICAL SURFACE GRINDERS

"Hill" Open Side Vertical Spindle Hydraulic Surface Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



SHEAR KNIVES

"CLEVELAND" Knives and Shear Blades. Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives.



HORIZONTAL SURFACE GRINDERS

"Hill" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths from 18" up to 36"; table lengths 60" to 240".

ABRASIVE BELT GRINDING & POLISHING MACHINE

(Pinch Roll Type)

For pre-finishing, conditioning and polishing sheets, plates, strips or blanked-out shapes in flat form. Used as single units or in multiple units for progressive line polishing.

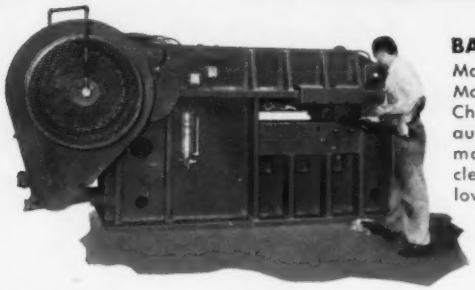
The basic HILL two-roll vertical head with endless abrasive belt. Used in both the Pinch-Roll and the Hydraulic Table types.

ABRASIVE BELT POLISHING MACHINE

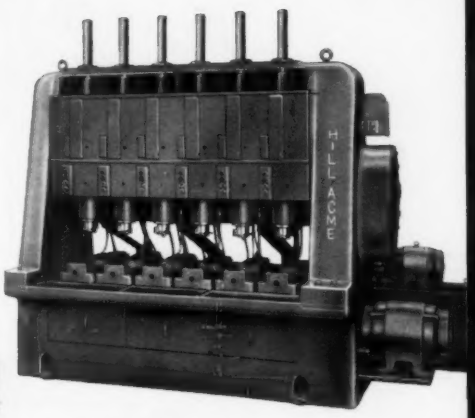
(Hydraulic Table Type)

For flat polishing of sheets and plates of ferrous and non-ferrous metals. Made in a variety of table widths and lengths with fully hydraulic reciprocating table.

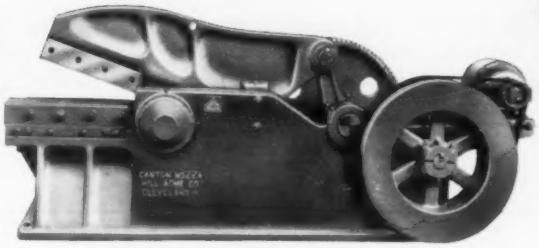
Tools for Industry



BAR-BILLET SHEARS
Modern, efficient design. Made in 3" to 6½" sizes. Choice of hand, semi-automatic or fully automatic feed. Assures clean, square cuts with low maintenance.

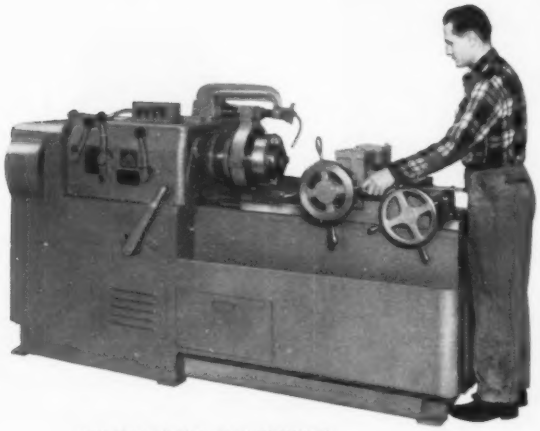


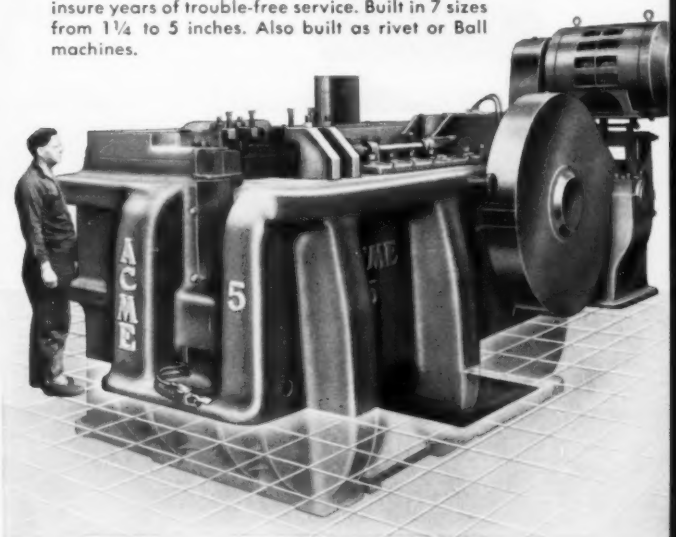
ALLIGATOR SHEARS
"CANTON" Alligator Shears are the most rugged, powerful and trouble free shears ever built for processing scrap. Modern design has produced a stronger shear, with fewer parts, and positive lubrication. Made in a full range of sizes to meet every condition.



TAPPING MACHINES
"ACME" model XC-W six spindle Coupling Tapper. Built in 1" capacity and larger, in 6 or 8 spindle. Can be adapted as a nut tapper.

FORGING MACHINES
"ACME" XN Forging Machines produce accurate, quality forgings for long uninterrupted periods. Massive construction and simplicity of operation insure years of trouble-free service. Built in 7 sizes from 1¼ to 5 inches. Also built as rivet or Ball machines.





THREADING MACHINES
"ACME" HA Single and Double Spindle Threading Machines are equipped with tangent or hob type die head which assures economical, accurate, high speed production. Furnished in sizes from 1" to 2½" capacity.

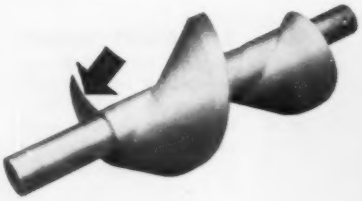
THE HILL ACME COMPANY

1201 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

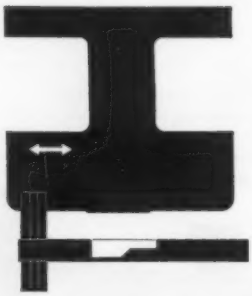
New turning idea is born...

1. Problem workpiece—spiral rotor for pumps. Roots-Connersville Blower Co., Connersville, Indiana, had been machining these rotors on a shaper. The trouble was . . .

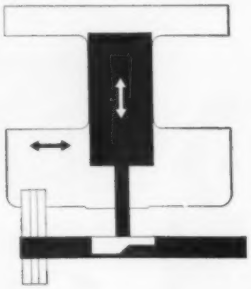


2. Shaping just couldn't produce the wide variety of exact contours their engineers wanted. Could rotors be *turned*—automatically?

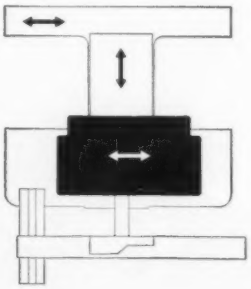
3. Why not? With special end gearing and full nut, we can "chase" the spiral shape like a coarse thread. That's easy . . . the problem is the contour.



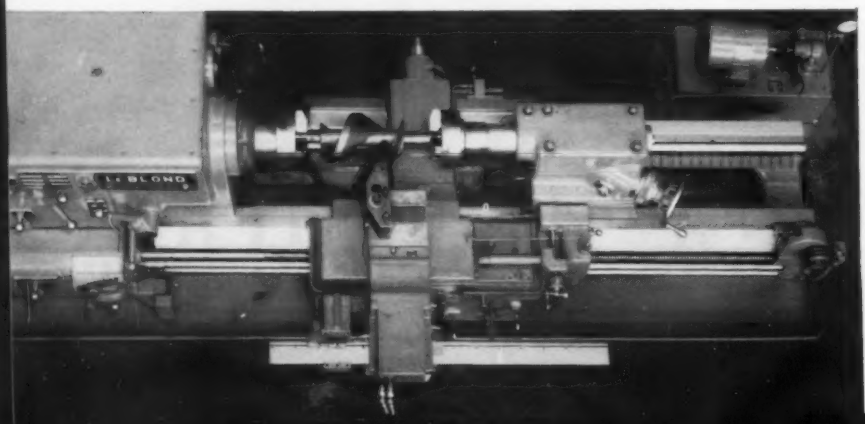
6. Let's see how this looks in plan. The carriage provides length motion for the tool. The template carrier moves lengthwise with the carriage.



7. The cross slide gives cross travel plus automatic tool relief. The template carrier also moves "in and out" with the cross slide.

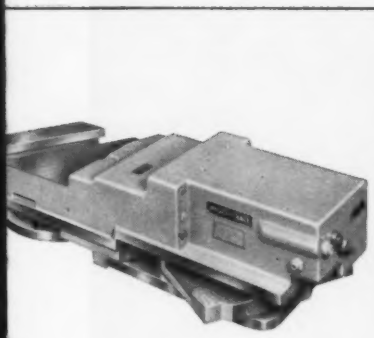


8. The special length slide gives us feed. Not continuous feed. Just tool-positioning feed that moves the stylus slightly along the template for each successive cut.



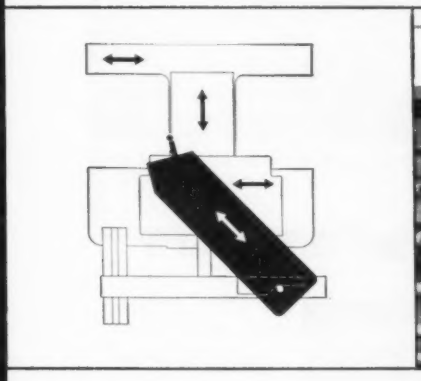
11. Here's the finished machine—the LeBlond Contour Chasing Lathe, basically a 32″ Standard Duty. Modifications include: special end-gearing, full nut, special length slide, automatic cycling and special heavy duty reversing electrics.

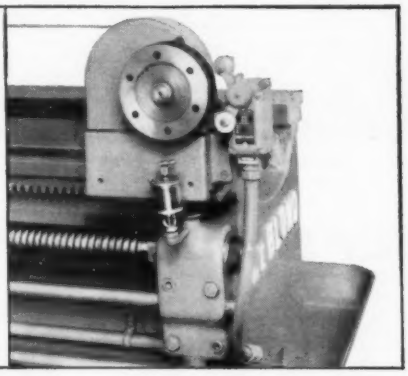
LeBlond Engineers turn trick with tracer



4. How about using Hydra-Trace? We've produced plenty of close tolerance contours with Hydra-Trace.

5. We'll use Hydra-Trace to *position* the tool (not to trace). We can mount a special length slide on the cross slide to give us feed *between* cuts.

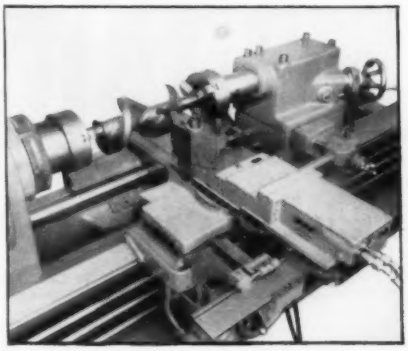




9. The template controlled Hydra-Trace positions the tool for each successive cut to produce the contour. During the cut, no feed takes place. Only the chasing action.

10. One more detail. Remember, the whole action must be automatic. We'll need automatic cycling and a tool release mechanism. That does it.

12. Rotor workpiece shown has 10″ lead— concave on one side, convex on the other. (Lathe chases leads from 4½″ to 16″.) On the left hand rotor, cutting is from headstock to tailstock. On mating right hand rotor, from tailstock to headstock.



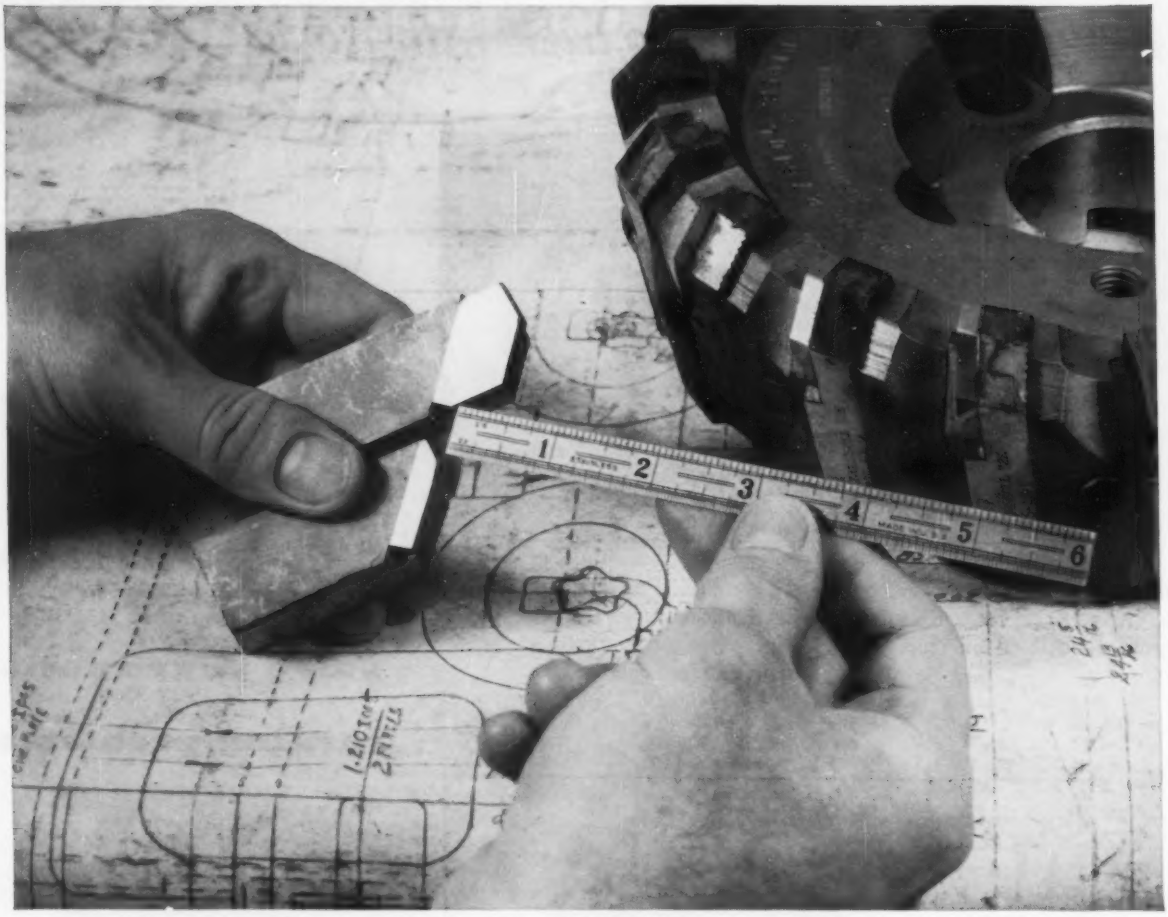
We welcome the opportunity to solve your special turning problems. Tell us about them. Call or write for an engineering appointment.

... cut with confidence

LeBLOND of Cincinnati

The R. K. Leblond Machine Tool Company
Cincinnati 8, Ohio

World's Largest Builder of a Complete Line of Lathes for More than 71 Years



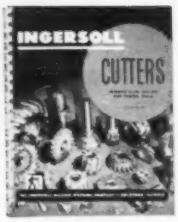
Ingersoll Heavy-Duty Shear Clear Face Mill designed for cast iron or steel. Size of bevel is varied to suit depth of stock.

What Does Your Scrap Barrel Show?

Do you get over ½" of blade wear? A look into your scrap barrel will show that many blades were wasted because of cracks, misuse, improper design or misapplication of the cutter and grade of carbide. You probably can't tell why these blades failed prematurely because so many variables are involved.

We are used to working with these variables and can help you reduce your tool costs. Part of our product is the continuous counsel of your Ingersoll representative and our cutter engineers. They will consider the machine, material, speed, feed and finish requirements before recommending the tool which will do the best job at the lowest cost.

We will welcome an opportunity to tell you more about this service. Write:



If you do not have a copy of this book, write us and we will send you one. It describes in detail the complete line of Ingersoll inserted blade milling and boring tools. Ask for Catalog #668

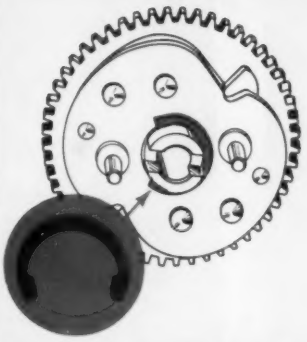
CUTTER DIVISION

THE INGERSOLL MILLING MACHINE COMPANY

505 FULTON AVENUE ROCKFORD, ILLINOIS

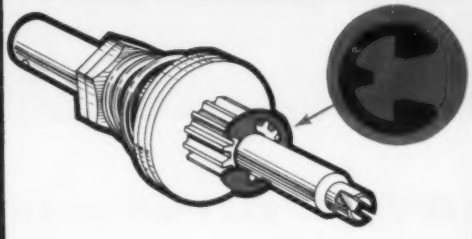
Waldes Truarc Rings speed assembly, facilitate maintenance, improve performance of new automatic calculator

THE NEW MARCHANT DECI•MAGIC automatic-decimals calculator made by Marchant Calculators, Inc., Oakland, California.

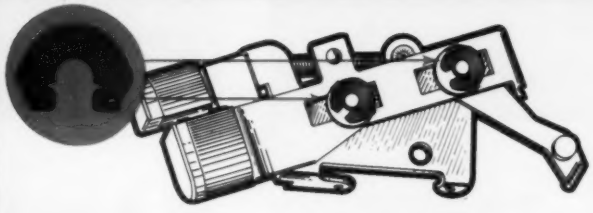


CRESCENT RING SPEEDS ASSEMBLY, DISASSEMBLY

Main clutch utilizes radially-installed series 5103 crescent ring for rapid assembly and disassembly. Ring's low protruding shoulder provides necessary clearance between ring and the two studs. The main clutch operates each time a Deci-Magic control key is depressed.



E-RING SECURES PARTS AGAINST SPRING THRUST. Slip clutch assembly uses Truarc series 5133 E-ring to hold parts on shaft. Functioning of the assembly is dependent upon the ring's ability to withstand thrust exerted by the heavy barrel spring.



LOCKING PRONG RINGS PERMIT SIMPLE DESIGN. Shift slide assembly uses two Truarc series 5139 bowed locking prong rings to lock the parts together in a sliding fit. Precise amount of spring tension prevents objectionable wobble and noise, permits the key to slide smoothly in operation. Easy radial assembly and disassembly of rings facilitates field maintenance and repair. Alternative construction would have required cut washer, spring washer and hairpin-type spring clip on each stud.

Whatever you make, there's a Waldes Truarc Ring designed to save you material, machining and labor costs, and to improve the functioning of your product.

In Truarc, you get

Complete Selection: 36 functionally different types. As many as 97 standard sizes within a ring type. 5 metal specifications and 14 different finishes. All types available quickly from leading OEM distributors in 90 stocking points throughout the U.S. and Canada.

Controlled Quality from engineering and raw materials through to the finished product. Every step in manufacture watched and checked in Waldes' own modern plant.

Field Engineering Service: More than 30 engineering-minded factory representatives and 700 field men are at your call.

Design and Engineering Service not only helps you select the proper type of ring for your purpose, but also helps you use it most efficiently. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

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RETAINING RINGS

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Please send new, descriptive catalog showing all types of Truarc rings and representative case history applications. *(Please print)*

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Title .....

Company .....

Business Address .....

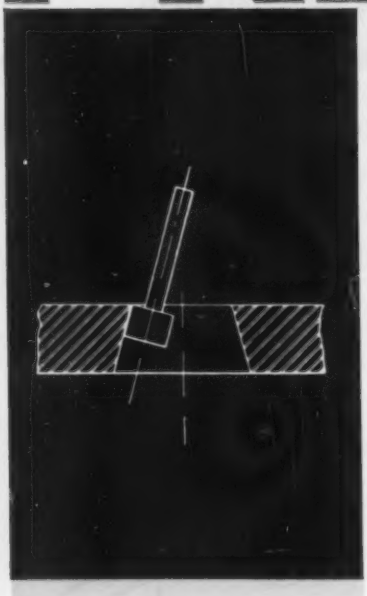
City ..... *Zone* *State* .....

M040

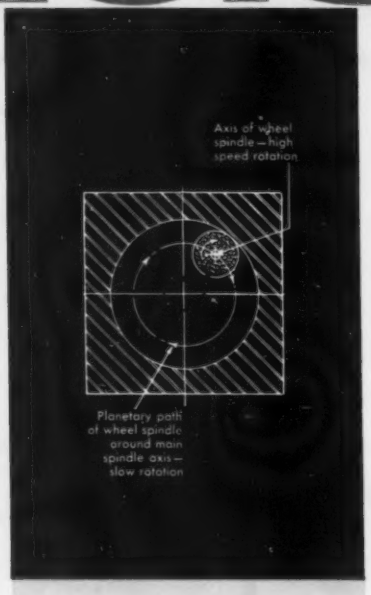
WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

For more information fill in page number on Inquiry Card, on page 195

PRECISION



TAPER
(*and straight*)



PLANETARY

OUTFEED wheel to grind hole; INFEED to grind O.D. of post
Axis of wheel spindle—high speed rotation
Planetary path of wheel spindle around main spindle axis—slow hand rotation

CONTOUR
(*with head*)

MOORE-FOSDICK JIG GRINDER

A new degree of speed, convenience and capacity is brought to precision grinding in the Moore-Fosdick Jig Grinders. This combination of the unique Moore Grinding Head with Fosdick Jig Borer Tables makes possible advantages never before available.

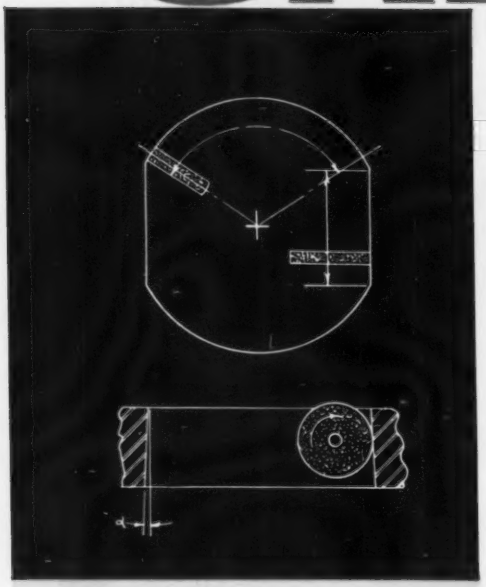
All standard jig grinding operations can speedily and conveniently be accomplished on the Moore-Fosdick, in addition to many which were formerly known as "trick" operations. Both straight and tapered holes can be located and ground, as well as contours consisting of radii and tangents or chordal surfaces.

The angular and indexing device built into the main spindle and the slot grinding attachment permit quick, accurate grinding of any contour, regular or irregular. Setting work on a rotary table is unnecessary except for angular surfaces. Chop grinding removes stock rapidly and makes contour grinding even faster.

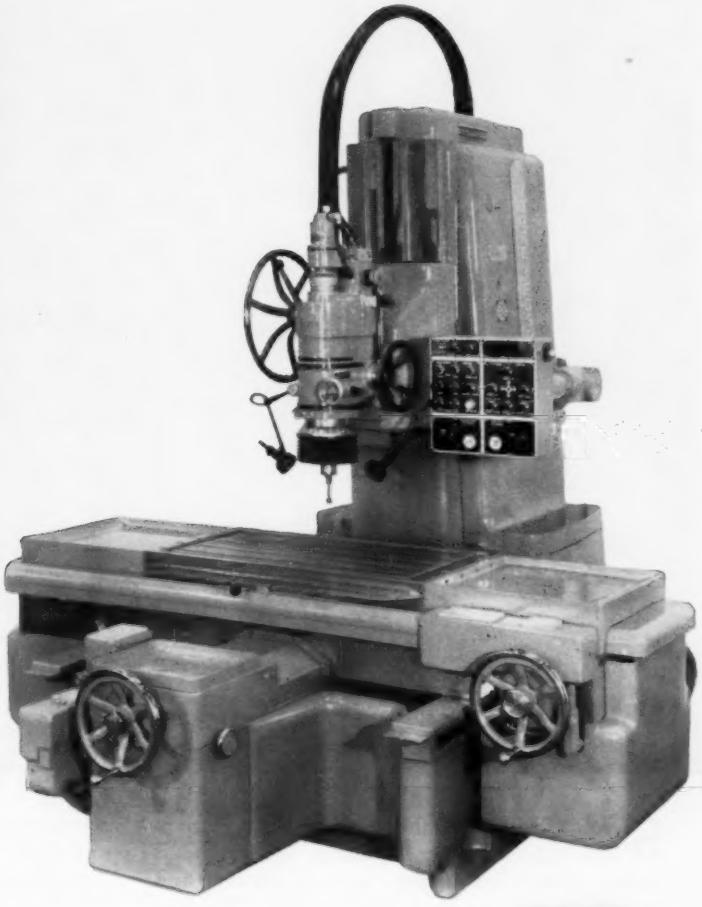
An infinite range of grinding speeds—from 12,000 to 60,000 rpm—allows accurate control

GRINDING

OF LARGE WORK



CONTOUR
. (with slot grinder)



of grinding and stock removal. Long-lasting precision is assured by quality construction and by many features that provide dimensional stability, including spindle-housing heat control.

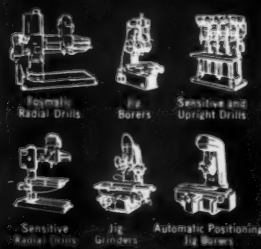
The machine may be ordered in any one of three models, one of which comes in two sizes. *All will give accuracy of ± .0001".*

Measuring is accomplished with measuring rods and inside micrometers or with Direct Dimension Measuring, where dimensions are simply set from blueprint to direct reading drum dials. Automatic positioning is also available.

Numerical control by punched tape or cards is available.

For a complete description of the various grinding operations, measuring systems and other machine features—many exclusive with Moore-Fosdick, write today for your jig grinder catalog.

Ask for Bulletin JG-M.



NEED DRILLING EQUIPMENT?
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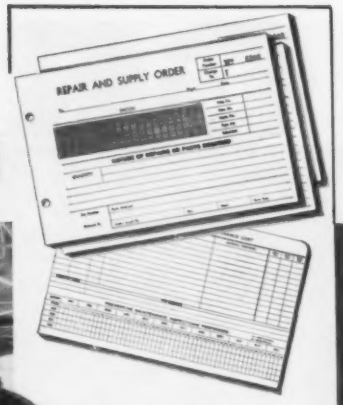
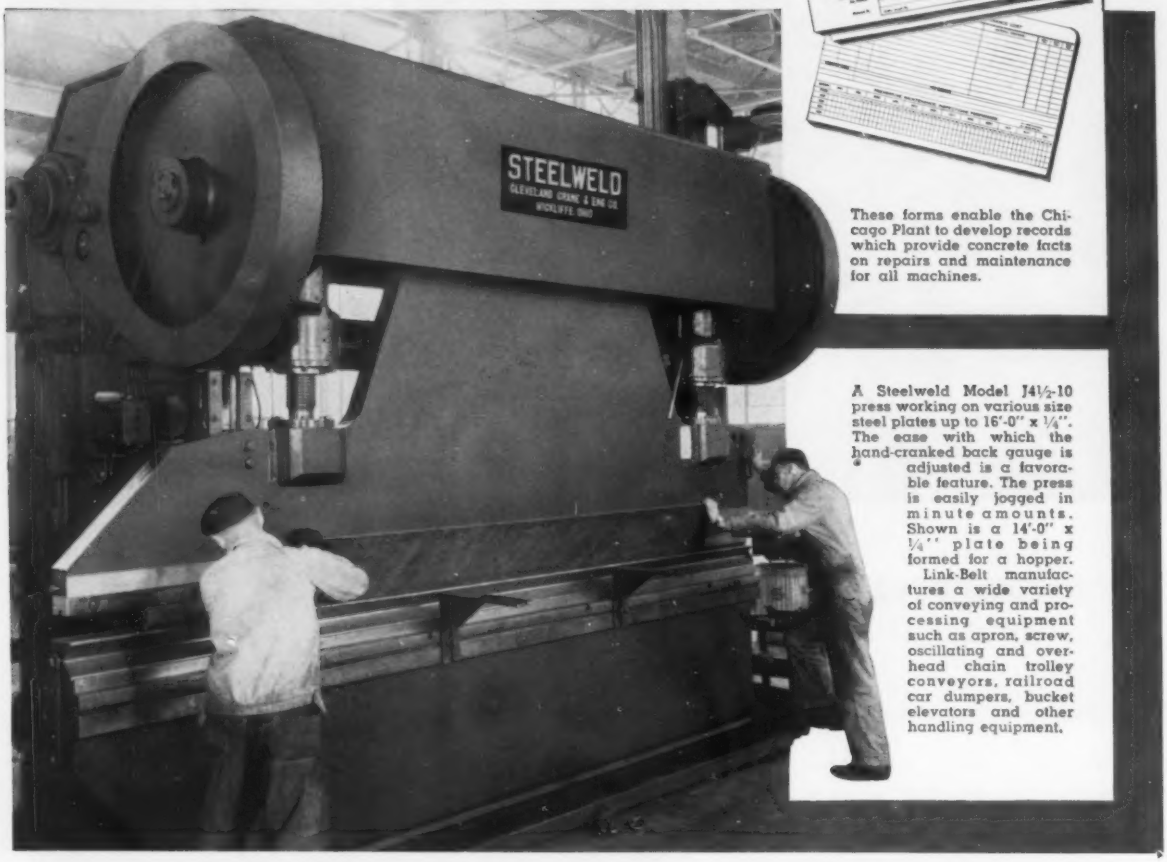
FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO

Accurate Records Prove
LOW COST OPERATION



These forms enable the Chicago Plant to develop records which provide concrete facts on repairs and maintenance for all machines.



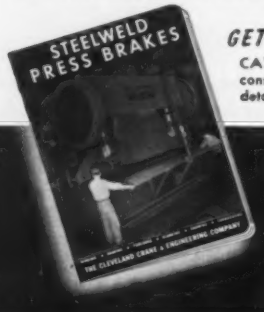
A Steelweld Model J4½-10 press working on various size steel plates up to 16'-0" x ¼". The ease with which the hand-cranked back gauge is adjusted is a favorable feature. The press is easily jogged in minute amounts. Shown is a 14'-0" x ¼" plate being formed for a hopper.

Link-Belt manufactures a wide variety of conveying and processing equipment such as apron, screw, oscillating and overhead chain trolley conveyors, railroad car dumpers, bucket elevators and other handling equipment.

SOME YEARS AGO the Pershing Road Plant of Link-Belt Company, Chicago, established a record system for keeping track of repairs and maintenance costs of all machine tools. This system provides a detailed history of maintenance required and lists every item of expense for every machine.

The record system proves that the maintenance cost for Steelweld machines, both bending presses and shears, is comparatively low.

Because of this, and the fact that Steelweld machines have many desirable operational features, a number of which are unavailable elsewhere, Link-Belt regards them highly. In fact, so much that 20 Steelweld Presses and Shears are now serving Link-Belt plants in nine cities.



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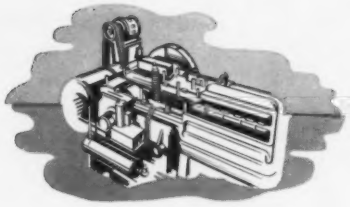
CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
5459 EAST 281st STREET • WICKLIFFE, OHIO

STEELWELD
PRESS BRAKES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

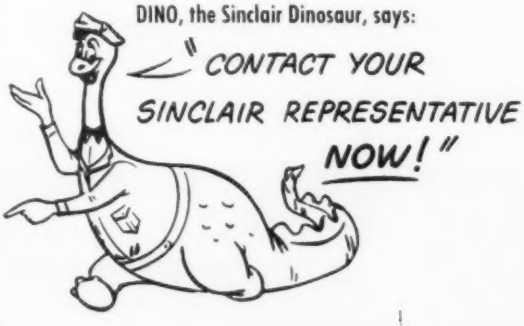


"For three weeks their production was zero"...

A midwest plant was faced with a serious production problem in aluminum extrusion. The operation, on a ⅜" cold upset extruder, was to form a clinching cap for a metal screw. In three weeks of experimentation they did not produce one acceptable product, although they had tried a variety of piercing tool lubricants, including both oil and wax.

The plant foreman called in J. V. Ritz, a Sinclair Area Engineer. Mr. Ritz reports: "After studying their lubrication problem, I decided that Sinclair TRUKUT,® used in the neat form, would provide the correct lubrication. Three hours after they followed this advice, their machine was producing perfect caps at full capacity. *In fact, they produced more caps in a twenty-minute run than had been produced in the previous three weeks.*"

If you have a lubrication problem in your machining operation, call on the experience of a Sinclair Lubrication Engineer. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*



SINCLAIR

CUTTING OILS and COOLANTS

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More pieces per man-hour in your plant can start right here

If you want to get more out of your man-power, think *first* of power chucking . . . on the machines in your shop or the lathes you are planning to buy.

The successful application of power chucking to your machines and your work calls for highly specialized and imaginative engineering know-how. Skinner puts by far the largest engineering team in the industry at your service through your nearby Industrial Distributor. Put your power chucking problems up to him, or, if you prefer, write directly to our engineering department.

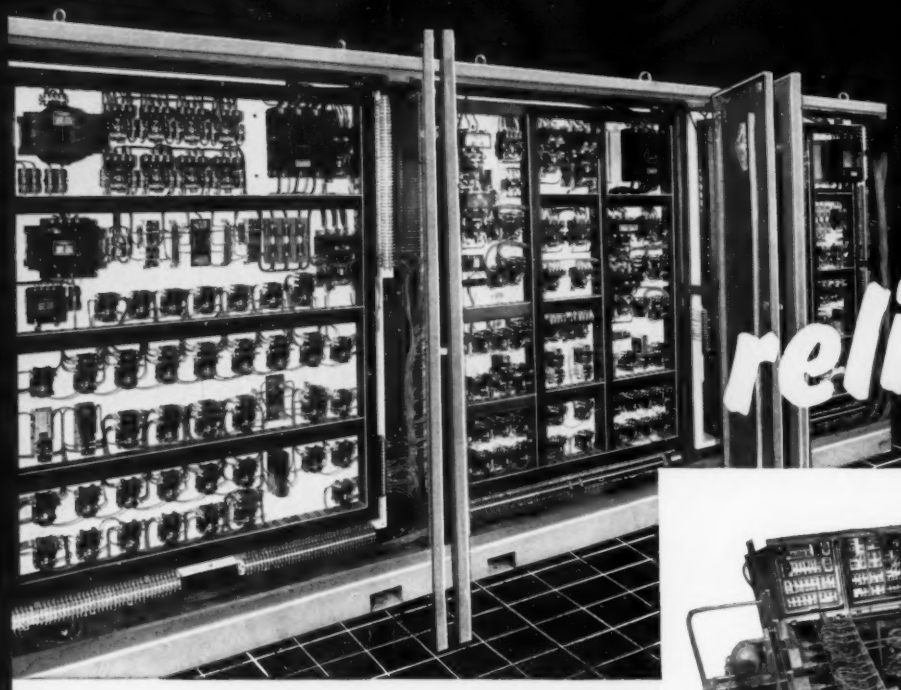
For information about Skinner's complete range of basic power chucking equipment, write for catalog to Dept. 154.

SKINNER CHUCKS

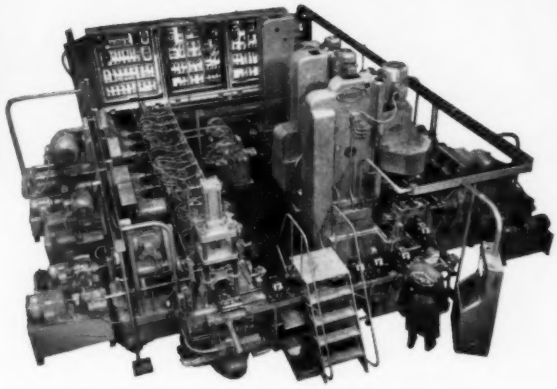
THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT



preferred . . . because it is reliable!



This Baker Automatic Transfer Machine is equipped with a special Allen-Bradley control panel, assembled from standard components listed in the latest A-B Handy Catalog.

ALLEN-BRADLEY MOTOR CONTROL QUALITY

Twenty-six machining operations are performed automatically on this huge transfer machine. To keep this machine operating continuously—to avoid costly production shutdowns—Baker Brothers, Inc., selected Allen-Bradley quality motor control—the simple control that is good for millions of trouble free operations.

The recognized reliability of Allen-Bradley motor starters and relays is the result of their simple design. Having only *one* moving part, wear and consequent trouble are reduced to the minimum. The double break, silver alloy contacts . . . standard throughout the Allen-Bradley line . . . never need attention. They are always in perfect operating condition.

Simplicity of design and silver alloy contacts are features of all Allen-Bradley control auxiliaries—they are similarly trouble free. Therefore, standardize on the Allen-Bradley line of *quality* motor starters, relays, push buttons, limit switches, and other accessories. You cannot possibly make a mistake!

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

BULLETIN 802T
Oiltight
Limit Switch

Has completely sealed operating head and switch body. This adjustable roller lever type saves installation time.

BULLETIN 700
Solenoid Relay

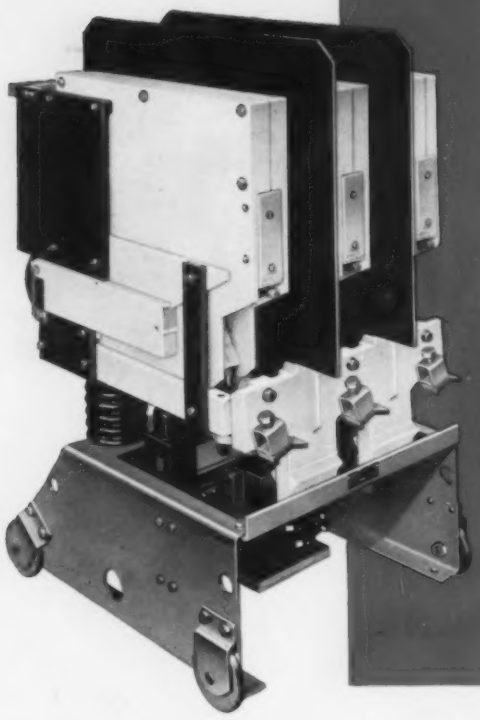
Universal type relay has contacts that can be connected for either "normally open" or "normally closed" operation.

BULLETIN 709
Solenoid
Starter
(Size 1)

Popular across-the-line starter with accurate and reliable overload relays. 8 Sizes to 300 hp, 220 v; 600 hp, 440-550 v.

4-58-R

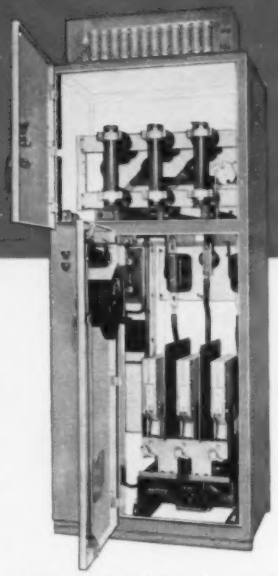
A-B QUALITY



Air break starters

for high voltage motors

A-B QUALITY



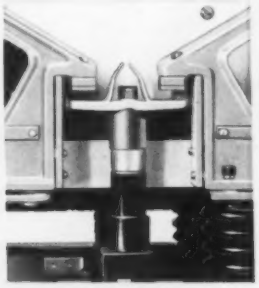
This *new* air break contactor—around which Allen-Bradley has developed a complete line of high voltage starters—is designed to match your *toughest* applications. It features the same solenoid design—with only *one* moving part—that has made Allen-Bradley low voltage starters universally recognized for their tremendous operating life.

These new contactors are available in full voltage and reduced voltage starters—nonreversing or reversing—for squirrel cage, part winding, slip ring, and synchronous motors up to 1500 hp, 2300 volts; 2500 hp, 4600 volts. All starters are equipped with current limiting fuses and have an interrupting capacity of 150,000 kva at 2300 volts and 250,000 kva at 4600 volts.

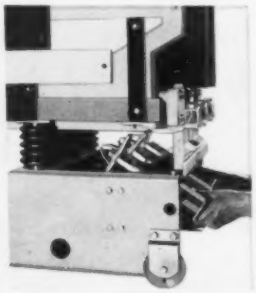
It will pay you to investigate these *quality* starters. Complete information is contained in Publication 6080 . . . please send for your copy, today.

Bulletin 966 high voltage air break, across-the-line synchronous motor starter in NEMA Type 1 enclosure.

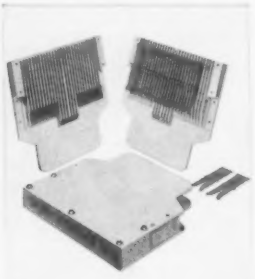
Only One Moving Part. Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.



Double Break Contacts of silver alloy never need maintenance. Vertical motion assures uniform contact pressures.



Easy Access from Front. Crossbar and contacts removable from front, without special tools, for easy inspection.



Faster Arc Suppression. New blowout design and novel arc chute. Chutes are molded from an arc resistant material.

Allen-Bradley Co.
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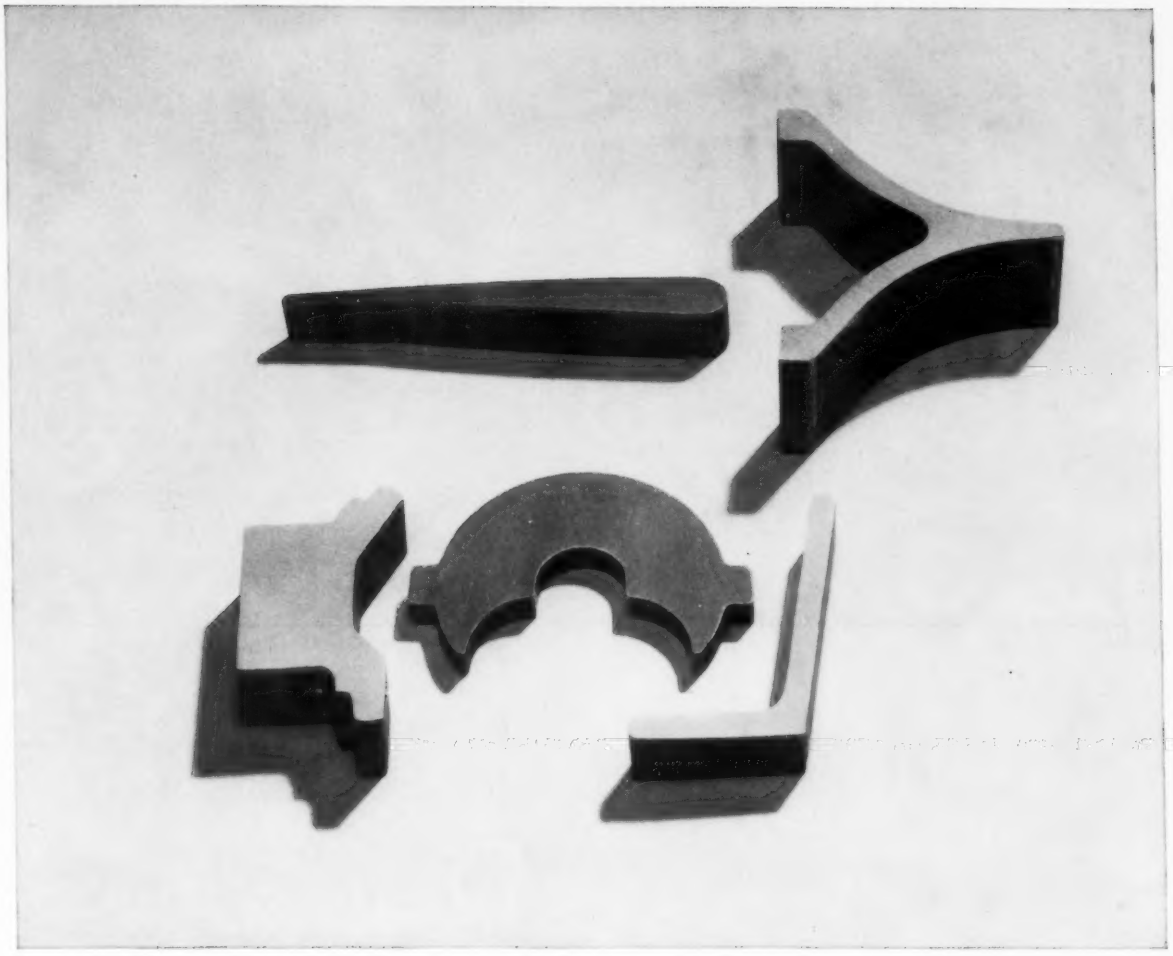
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ontario

4-58-MR

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY



Intricate Allegheny Ludlum Steel Extrusions

cut material needs up to 60%, slash machining costs

Write for this technical book on A-L Steel Extrusions

12-pages of design and engineering information on steel extrusions. Process and product explanation, material properties, design tips and limitations, tolerances, order instructions, etc.

Address Dept. M-4

There's no doubt about extruded shapes saving money on materials and on machining. Non-ferrous applications in the last decade have proven it.

Now even greater savings are possible with tough, strong metals in Allegheny Ludlum Hot Steel Extrusions.

Extruded shapes in all stainless grades, tool steels, carbon steels, electrical steels, high temperature alloys . . . even in zirconium, nickel alloys . . . are now in production at Allegheny Ludlum, cutting costs in many different industries.

If you're hogging out sections, paying for special mill rolls on small orders, or waiting for minimum rolling mill tonnages, Allegheny Ludlum Steel Extrusions are your answer. They will save you scrap loss, slash your machining costs, hold down your inventory requirements and cut delivery time. Charge for die design is low—under $200. Orders taken for as little as 40 pounds.

To learn more about the time and cost-cutting possibilities of Allegheny Ludlum Hot Steel Extrusions, send for the technical booklet at the left or call any A-L office for technical assistance.

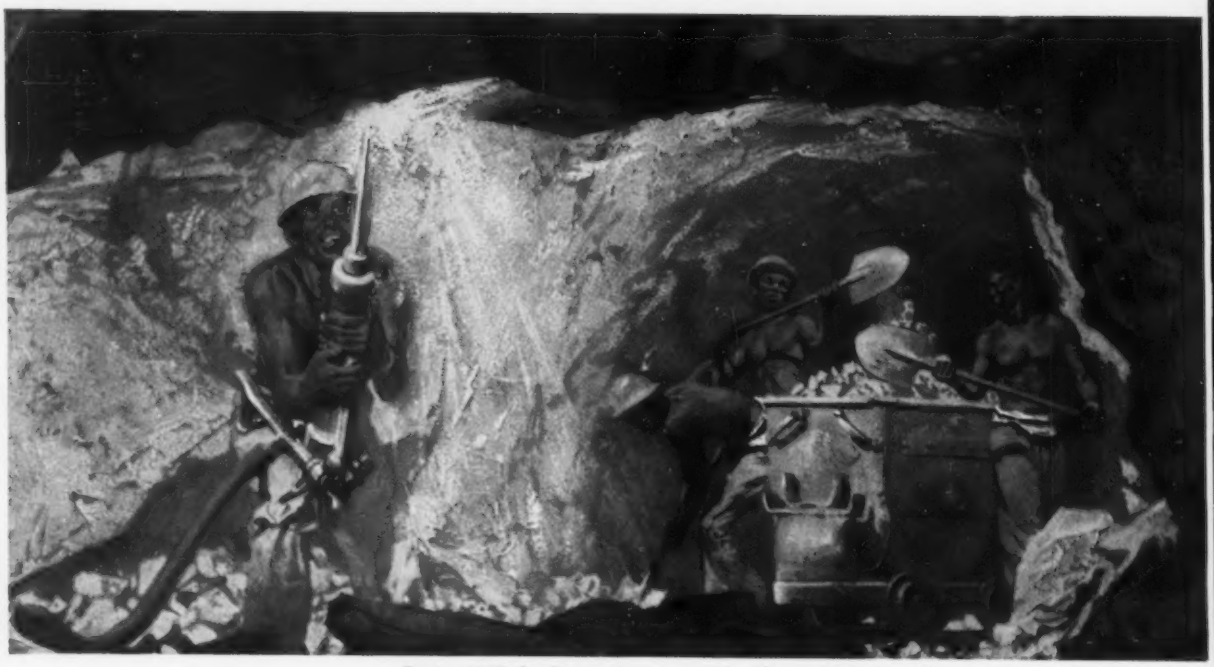
Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.

WSW 6907

ALLEGHENY LUDLUM

for all your special steel needs

Stainless and high-temperature, electrical and tool steels, magnetic materials, and sintered carbide



During 1957 the diamonds processed by Norton for industrial purposes were far greater,

How diamonds...
become Industry's

List Price $32,540 — and well worth it! This Norton diamond wheel, built for a prominent ceramics manufacturer, precision-grinds extremely hard parts. Its ability to last so much longer and grind so much better than other wheels more than justifies its first cost.

Your safeguard in buying diamond wheels is Norton leadership in their development and manufacture

Norton was first to introduce bonded diamond wheels . . . all three types: resinoid, metal and vitrified . . . does all its own checking and sizing of diamonds . . . certifies the diamond content . . . duplicates wheel specifications with consistent accuracy . . . brings you a complete line, covering every application.

For Internal Grinding Norton makes these smallest diamond wheels, together with every other size and type required for surface or cylindrical grinding, sharpening, sawing or cutting-off. And each wheel has the long-lasting excellence that assures the user steady profits.

in number and in total carat weight, than were available as gem diamonds in the U. S.

mined or man-made...
Crown Jewels

This leadership, firmly established by producing the finest cutting diamond wheels, began when only natural diamonds, known as bort, were available for industrial use. In 1930, Norton was first in this country to make, and in 1934 first to sell, successfully developed bonded diamond wheels.

And today, similar pioneering by Norton is assured in the processing of grinding wheels using diamonds, mined or man-made. That is why Norton diamond wheels continue to live up to their long-established reputations for exceptional value.

And that is why they are recognized as the *Crown Jewels* of industry — not only for familiar grinding operations on carbides, ceramics, stone and glass, but for solving the grinding problems of new metals, alloys and materials. Your Norton Abrasive Engineer or Norton Distributor will be glad to give you prompt service and additional facts about diamond wheels. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

NORTON

ABRASIVES

NORTON PRODUCTS

Abrasives • Grinding Wheels • Grinding Machines • Refractories

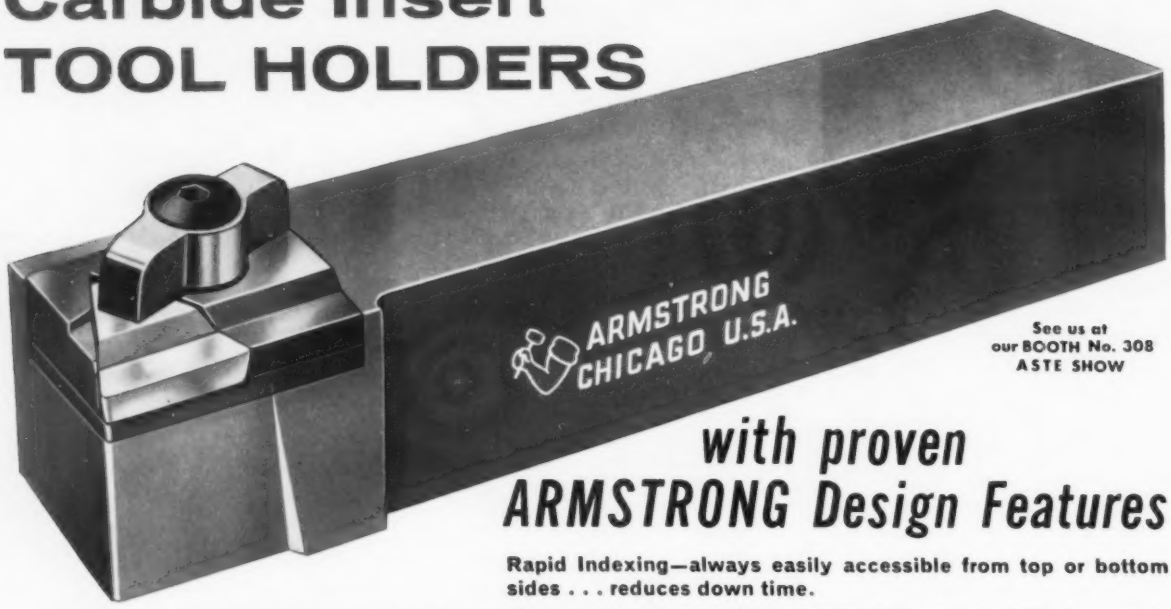
BEHR-MANNING DIVISION

Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Making better products...to make your products better

New Positive Rake ARMSTRONG

Carbide Insert TOOL HOLDERS



See us at
our BOOTH No. 308
ASTE SHOW

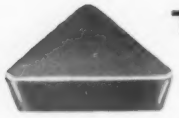
with proven ARMSTRONG Design Features

Rapid Indexing—always easily accessible from top or bottom sides . . . reduces down time.

Replaceable Seat of Hardened Tool Steel—prevents damage to shank.

Huskier shanks of Heat Treated Alloy Steel—for added strength and rigidity.

Shank Styles for Use in both Conventional and Open Side Tool Posts.



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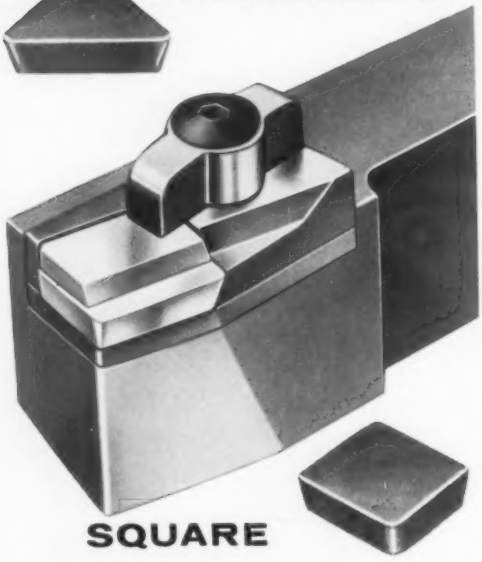
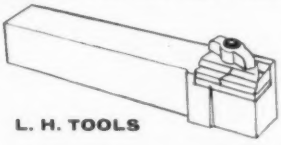


SQUARE

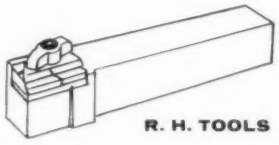
These positive rake Carbide Insert Tool Holders are for every day tool room and production turning on engine lathes, turret lathes and screw machines. They permit increased cutting speeds associated with the use of carbides and they entirely eliminate carbide tool grinding.

Low cost positive rake ARMIDE "throw away" Inserts provide three or four cutting edges per insert. Triangular inserts have three, square inserts four cutting edges. They are available in three grades of ARMIDE: 350, 370 or 883.

Buy positive and negative rake Carbide Insert Tool Holders which carry the ARMSTRONG trade mark; leader in tool holders and cutting tools for over sixty years.



L. H. TOOLS



R. H. TOOLS

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVENUE CHICAGO 46, ILL.

Buy ARMSTRONG TOOLS from your Industrial Distributor

That's a good question. Not so many years ago, it was anybody's guess. At times machines were replaced through sheer necessity because they were allowed to run until they broke down completely.

Today management men with a keen eye on profits are going about machinery replacements with more scientific methods. They use formal machinery and equipment replacement programs that reveal the most profitable time to replace. They use formal work sheets which guide them into full and orderly consideration of all factors necessary to profitable replacements.

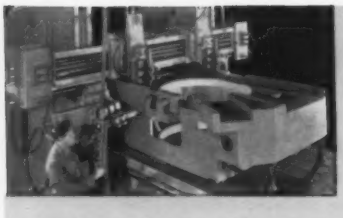
If *you* haven't looked into the possibilities of scientific machinery and equipment buying practices, we urge you to do so. The statements from other manufacturers give evidence to the fact that it is extremely worthwhile. Start it off by writing for this recently enlarged book. It explains what these other companies are doing and the results. For your copy, write to any one of the companies in this group.

Rockford Insert-Group

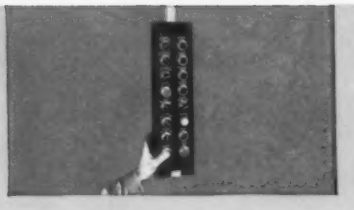
Keep gathering metal-working production ideas . . . be well informed when you replace machinery . . .

April, 1958

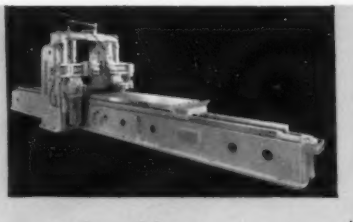
facts about hy-draulic design...



is smooth, powerful, wear-free.



is infinitely controlled, with infinitely variable speeds and pressures.



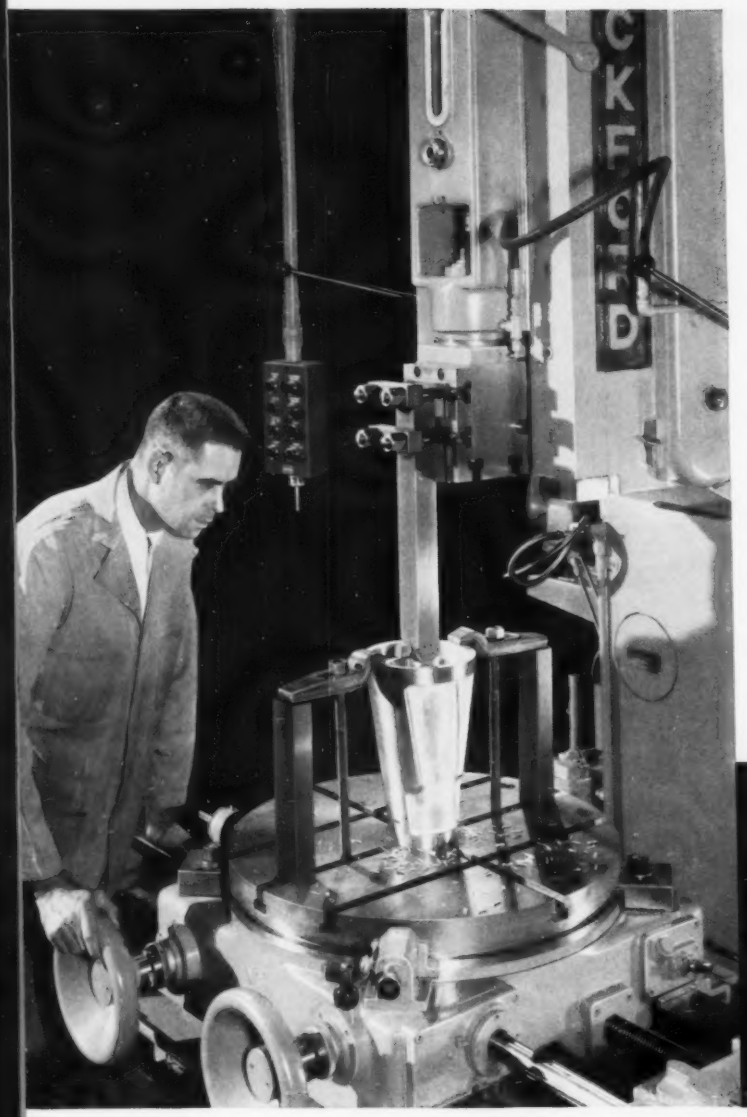
requires minimum maintenance.

absorbs all shock and overloads, without mechanical or electrical failure.

is simple to operate, designed for overall operator efficiency.

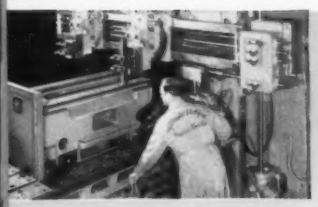
increases tool life, permits instant selection of optimum cutting speeds.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



new **hy-draulic slotter** with traveling column

For greater capacity, this machine permits variable relationships between the table and the column.



permits fast, shockless reversals, delivers more strokes per minute.

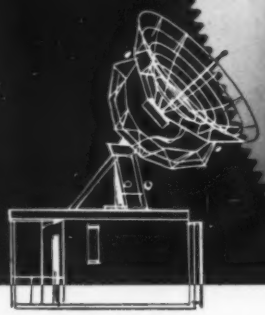
with absence of mechanical parts, provides freedom from wear and chatter, assures maximum accuracy with longer machine life.

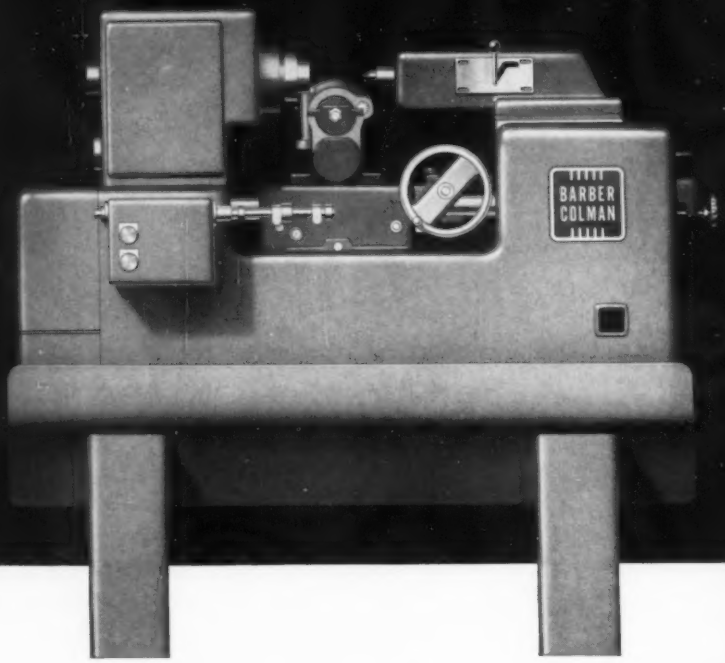
...only with hy-draulic design do you get these advantages!

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street • Rockford, Illinois

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

designed for...





Machinery, April, 1958

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

. . precision instrument gears

new Barber-Colman hobber guaranteed to index accurately within 20 seconds of arc

Barber-Colman engineers have developed a new hobbing machine which guarantees indexing accuracy suited to gears used for aircraft, missile and radar guidance systems. This machine is known as the No. 2½ - 4 hobbing machine and hobs precision spur gears up to 2½" diameter x 4" length, 30 D.P. in steel and 20 D.P. in brass. It provides accuracy, capacity and rigidity for precision fine-pitch work within a nominal price range.

One of the most important features of the new No. 2½ - 4 hobbing machine is the accuracy of relative rotation between the work spindle and the hob spindle which is guaranteed within 20 seconds of arc. This means that the spacing error on the gear caused by the indexing error of the machine would not exceed .00014" on a 2½" diameter gear.

The machine has a capacity for using 3" diameter hobs providing for a greater number of flutes to produce smooth gear tooth profiles. Using proper care in rigid tooling, accurate blanks, mounting of hob and work, and Class AA hobs with accurate sharpening, precision gears to Class 3 tolerances are hobbed with this machine.

Several design features are a departure from standard hobbing machine construction. There is no hob slide — only a hob carriage for conventional feed. In place of a hob slide, the hob arbor is mounted on a swivel which adjusts to compensate for hob thread angle. The work slide is stationary, and the hob swivel raises and lowers to meet diameter requirements. The machine has no overarm support, permitting greater work visibility and operator access. Both work and hob spindles are mounted in precision anti-friction bearings to provide accurate rotation at high speeds. The hob carriage also has anti-friction way supports, and the metal-to-metal contact afforded provides more rigidity than obtained with gib-type mounting. An infinite number of hob speeds are provided without change gears in the range of 200 to 1200 r.p.m.

Rigidly constructed, with a steel weldment base and heavy grey iron machine bed, the machine is designed with a minimum number of parts at points where deflection and inaccuracies may occur. Net machine weight without tooling is approximately 1500 lbs. Standard equipment includes motor and controls and one set of change gears.

For complete specifications and data contact your nearest Barber-Colman representative, or write directly to the factory for a copy of new bulletin F-8642. Orders are now being booked for July and August deliveries.

BARBER-COLMAN COMPANY

724 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

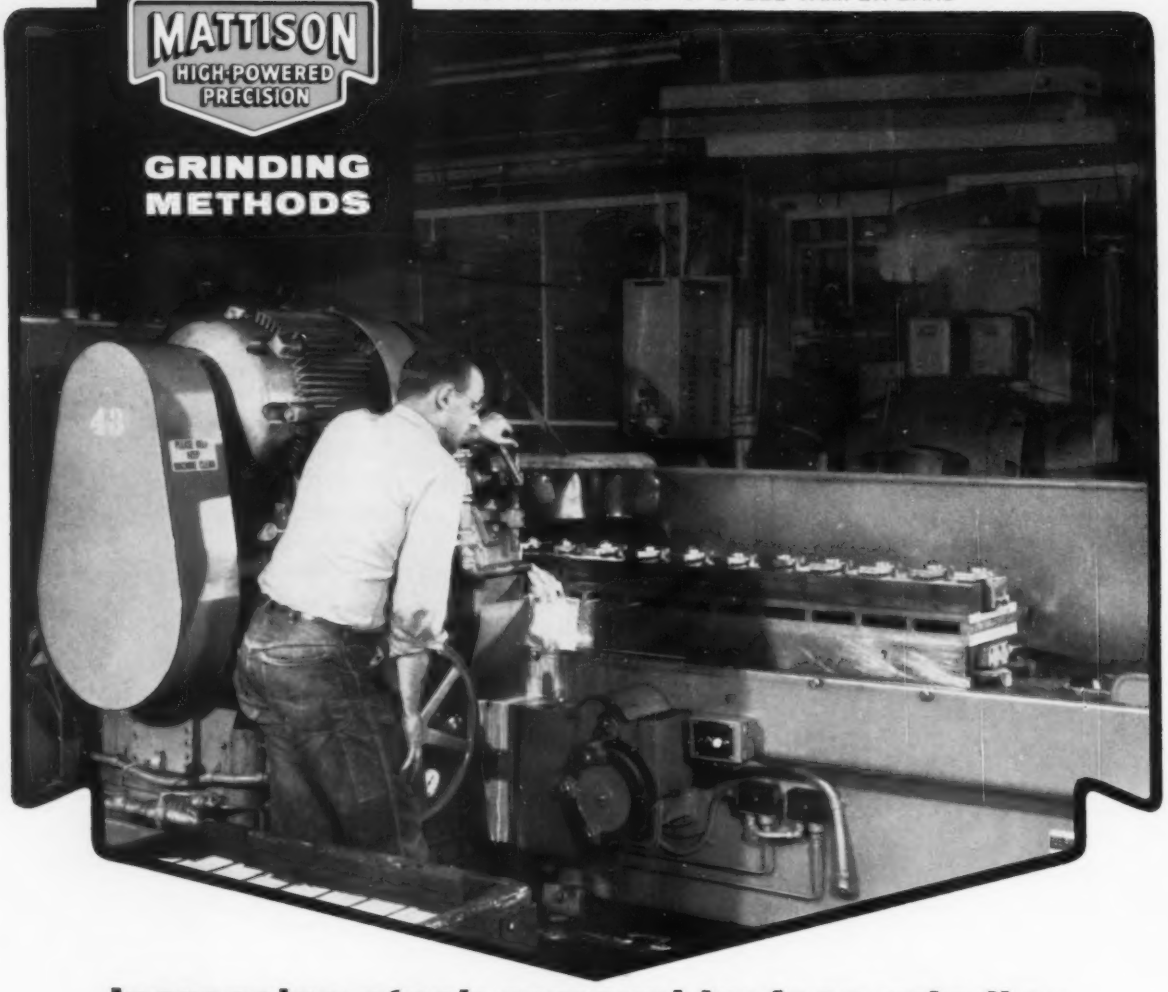
BARBER COLMAN

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 42—STEEL TAMPER BARS

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



Increasing stock removal by face grinding boosts production 26% . . . rejects eliminated!

Tough steel tamper bars, up to 15 in. long, are ground flat within .005 in. Hardness is 54-57 Rockwell (C).

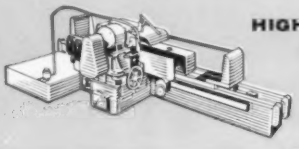
Greater contact area of the segmented wheel, backed up by rigidity and high horsepower of the Mattison No. 4000 hydraulic-feed face grinder, produced valuable production benefits in grinding tamper bars at the Barber-Greene Company, Aurora, Illinois.

The tough steel bars must be ground within .005 in. for flatness. Production officials of the company say: "Our grinder takes a good, deep cut out of the bars and does it speedily, without overheating." Time-study figures compiled over a three-month period show the following production gains over the old method: 19% increase grinding both ends; 29% increase grinding edges; and 30% increase grinding flats, an average of 26% gain in all operations on the "Mattison."

If you are doing a production machining job by milling, planing, shaping, or peripheral grinding, a Mattison face grinder or vertical spindle surface grinder probably can help you improve quality and reduce costs.

At Barber-Greene, for example, each of the wheel segments offers *ten square inches* of grinding surface in actual contact with the work, permitting high stock removal and efficient coolant distribution for fast grinding with minimum heat generation. Your Mattison dealer can arrange to have your parts test-ground in the Mattison Methods Laboratory.

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

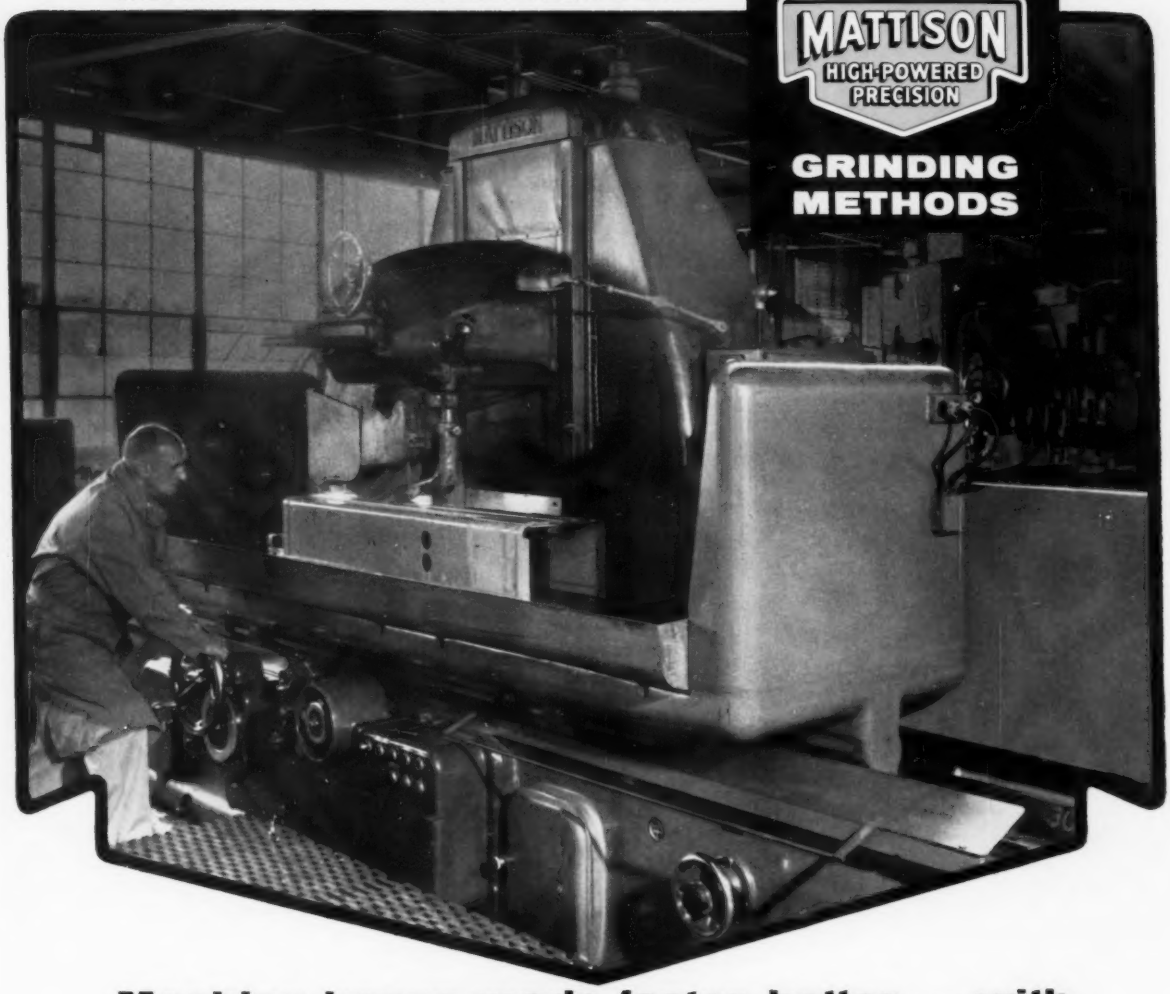


HIGH-POWERED
PRECISION
SURFACE
GRINDERS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 43—FABRICATED MACHINE BASES

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

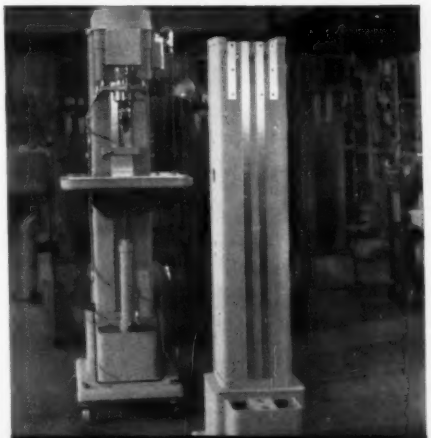


Machine bases made faster, better . . . with switch to steel fabrication and surface grinding!

"Following the installation of our Mattison surface grinder two years ago, we were able to accelerate production by 100%, improve accuracy, reduce wheel dressing by 700%, facilitate assembly, maintain consistently better finish, increase wheel width, achieve positive cooling, eliminate chatter, and retain our tool quality without price increases to our customers," says Mr. Herman Goldberg, president of the Snow Manufacturing Company, Bellwood, Illinois.

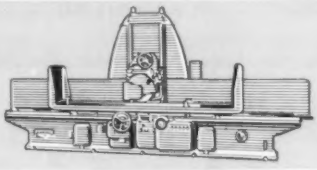
Installation of the grinder was part of a program which involved switching from cast iron to fabricated steel machine bases and replacement of milling with surface grinding. Now, this company is converted to steel fabrication and precision grinding in 98% of its machine construction, with improvements in productivity and quality.

Vitally important to precision of this company's line of single- and multiple-spindle precision drilling and tapping machines is accurate machining of the 59-inch-long channels on the vertical main frames shown at the right. All surfaces on the frames are now ground on the Mattison to limits of plus or minus .005 in., and flatness is held to .0015 in. over the entire length of the channels. Vise jaws for fixtures are held to within .0003 in., and parallelism of dovetail assemblies is held to .0005 in. over a 38-inch length.



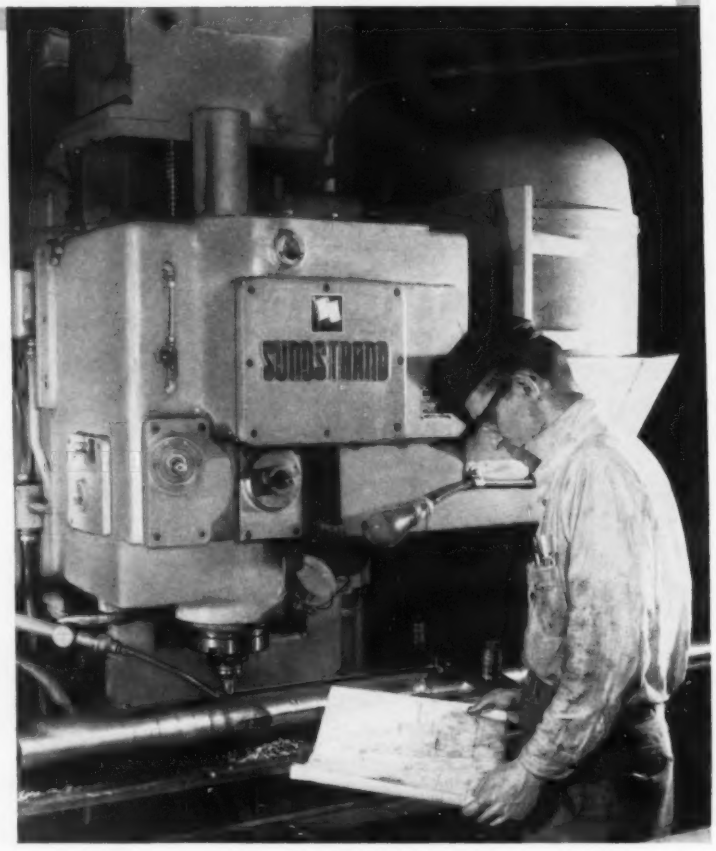
Flatness of 59-inch-long channels is held to .0015-inch over entire length.

If it's a flat surface, there's a Mattison to grind it!



FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Rigidmil Boosts Keyway Output 40% at Jones & Laughlin



Milling keyways on tough steel shafts for rolling mills at Jones & Laughlin Steel Corp.'s Pittsburgh Works requires a machine with the unmatched sturdiness and accuracy of the Sundstrand Rigidmil. Since the machine went into production a little over a year ago, these benefits have been realized:

1. Production is up 40 per cent. Hourly output varies depending on the shaft size.

2. Accuracy is way up, tolerance within .001-inch is maintained readily. Surface finish realized is just below grinding standards.

3. Maintenance time is way down, is no longer a factor in total operating costs.

4. Rigidmil handles work up to 12 inches in diameter, compared with 9 inches formerly.

5. Finish cutters can be used for the complete job on keyways up to 2 inches, eliminating need for tool change.

This capacity for turning out work to exceptionally high quality standards over a broad range of parts is characteristic of Sundstrand Rigidmils. Finger-tip control and maximum operator convenience cut the time between setups and keep the machine in production a higher percentage of the time than is possible with conventional machines. Features such as these, plus the application of Sundstrand "Engineered Production" to your specific needs, are your assurance of top efficiency whether you are interested in job lots or high volume.

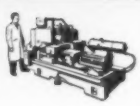
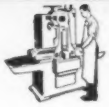
Write for Bulletin 690 describing Sundstrand's new C Model Rigidmils.

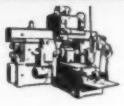
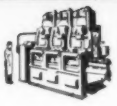
SUNDSTRAND MACHINE TOOL CO.

2530 ELEVENTH ST., ROCKFORD, ILLINOIS

SUNDSTRAND "Engineered Production" Service" *REG. U.S. PAT. OFF.

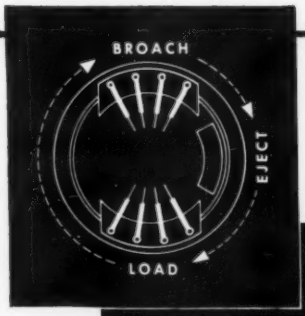
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS | TRIPLEX RIGIDMILS | SPECIAL MACHINES

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Efficient Fixturing Produces 1100 Broached Yokes Per Hour!



Parts are loaded at front, broached four at a time, and ejected automatically into chute at right.

Broaching more than 1100 shock absorber yokes per hour is a smooth-running operation on this American pull-down broaching machine equipped with a special radial indexing fixture. While machine broaches the inside diameter of four yokes at a time, operator readily loads four more parts into the opposite radial stations. Finished parts are ejected automatically as fixture indexes 90 degrees in the push-button-controlled machine cycle.

Production and accuracy go up while costs tumble when you apply American's "Engineered Production" to your manufacturing problems — whether you need standard or special machines. It's the best way to add years of production and design engineering experience to your staff — and it costs you nothing extra.

Write today for your copy of Bulletin A-625 "Practical Broaching Methods."

"Engineered Production" Service
FOR BROACHING

It takes All 3 for peak broaching performance

1 *Proper Broach Tool Design* — This logical first step in solving a broaching problem requires consideration of stock removal, length and width of cut, finish, tolerances, etc., so broach fixture and machine operate as a team.

2 *Specifying the Right Machine* — Production rate required, length and speed of stroke, floor space, and relationship with other production machinery are all considered before choosing the machine for a job.

3 *Efficient Fixturing* — This vital third link in the production chain enables production schedules to be met even with inexperienced operators because fixtures are provided with the skills "built in."

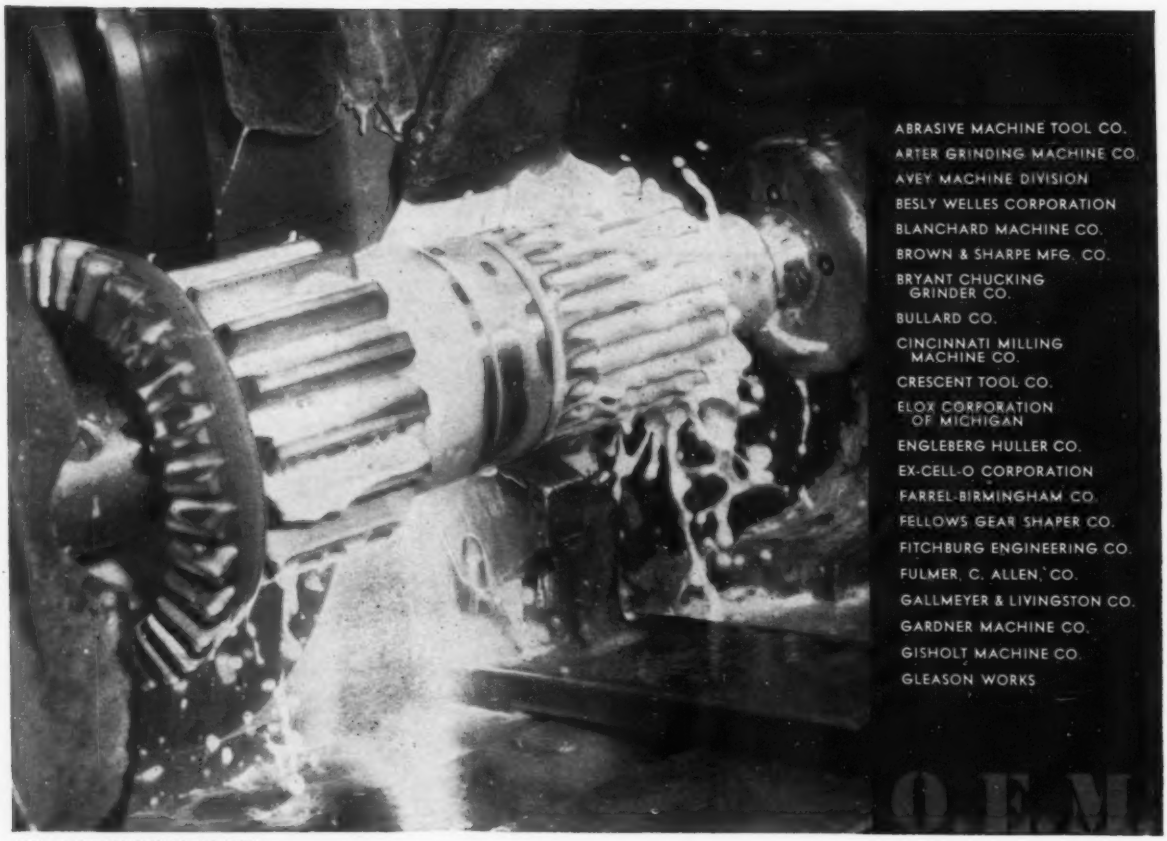
American BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL CO., ANN ARBOR, MICHIGAN

BROACHING TOOLS | THREE WAY | SINGLE RAM | HORIZONTAL | DUPLEX RAM | PRESSES

SUNDSTRAND "Engineered Production" Service"

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



COOLANT SHOWN COURTESY JOHNSON'S WAX

A good way to insure satisfied machine tool customers—

furnish BARNESDRIL COOLANT CLEANING AS ORIGINAL EQUIPMENT!

These builders know customers are better satisfied when machines have BarnesdriL Coolant Cleaning furnished as original equipment — because they get satisfactory machine performance over a longer period of time.

When machines are designed and built to perform specific operations held to close tolerances, customers expect these results *continuously*. This is possible only if initial operating conditions are maintained. Clean, conditioned coolant supply for these operations assures peak operating conditions with close tolerances and fine finish. As a result, machine performance is satisfactory over long periods of time.

BarnesdriL also assumes responsibility for its Coolant Cleaning Units, installed as original equipment, and our regular sales and service policy applies with no cost to the machine builder. Why not ask BarnesdriL engineers for full details on the benefits of Coolant Cleaning.

BARNES DRILL CO.

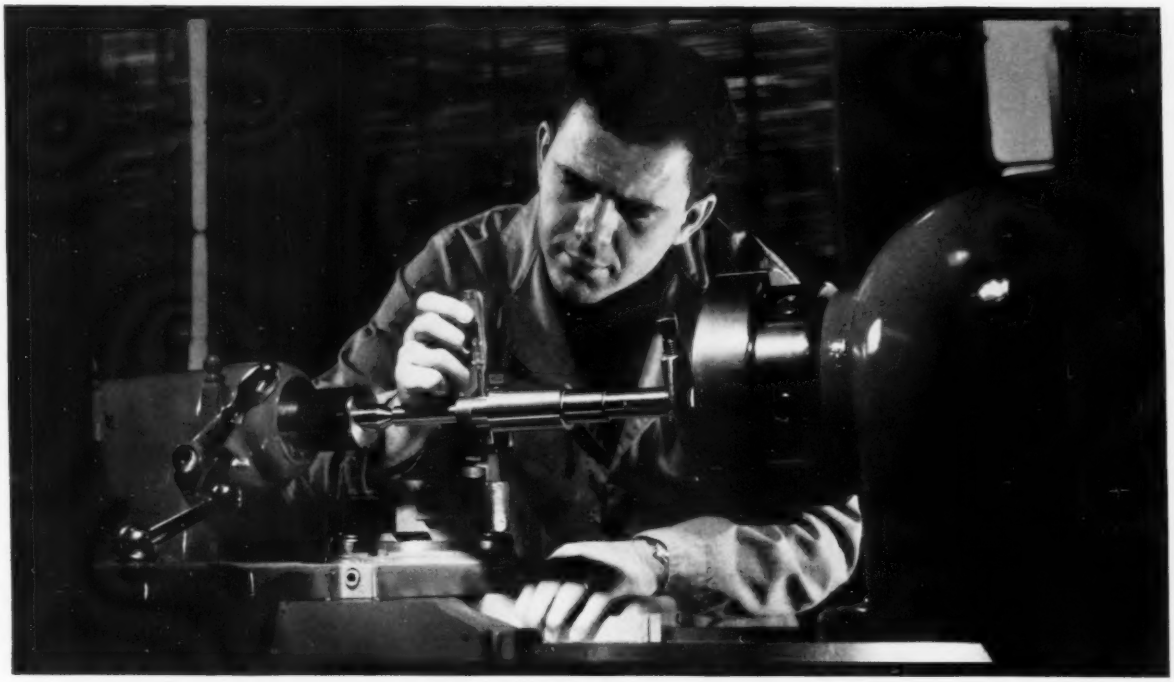
820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

MANUFACTURERS OF MAGNETIC COOLANT SEPARATORS • KLEENALL SEPARATORS AND FILTERS • CENTRAL COOLANT CLEANING SYSTEMS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

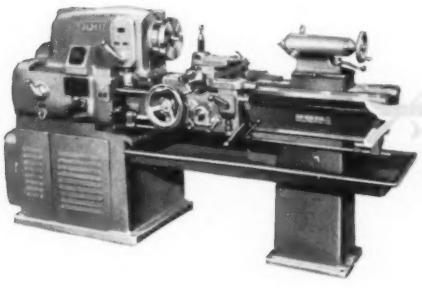
You get more short-run, high-precision jobs off a Barber-Colman No. 2E Lathe

timesaving controls step up efficiency of toolroom or production turning!



Because all controls were designed with the operator in mind, the Hendey No. 2-E general-purpose lathe today is setting new standards of efficiency on both toolroom and production jobs. Two outstanding features are the electronic drive that permits infinitely variable speed control, and the instantaneous dynamic brake for rapid stopping and reversing of the spindle.

Here are more Hendey "top-value" features you'll want to check further: quick-change gearbox providing 48 changes of threads without changing gears; thread-chasing dial for returning carriage to the same thread groove; quick-change gearbox for 48 changes of feed without gear change; pushbutton energizing of main motor; and *two* control levers, permitting operator to start, stop, or reverse the spindle from any working position. Contact your nearby Hendey dealer for complete details and specifications.



Hendey **machine division**

BARBER-COLMAN COMPANY

72 Loomis St., Rockford, Illinois

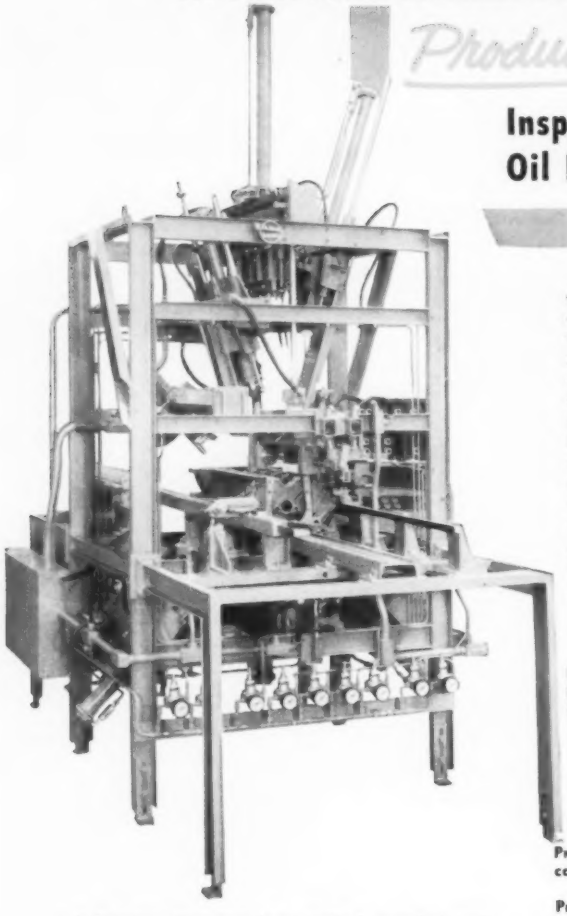
BARBER COLMAN ®

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

SPECIAL

W. F. & JOHN BARNES MACHINE *Solves Production Line Problem*

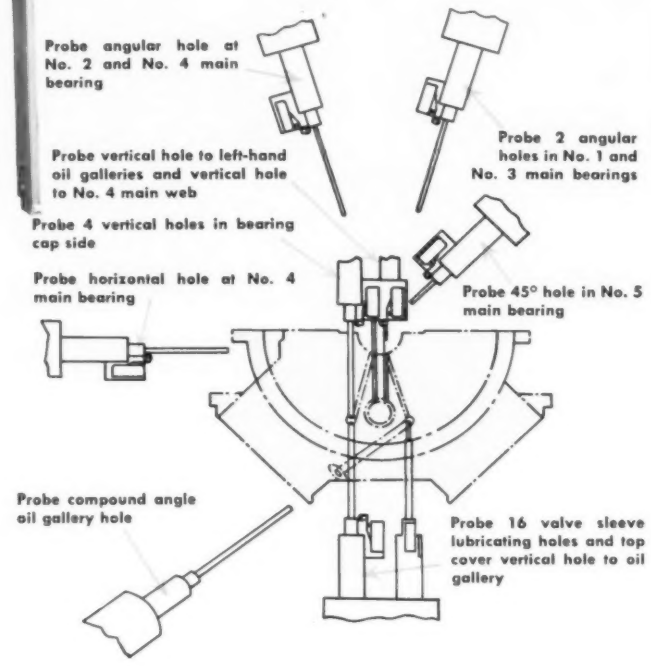
Inspects 36 Cylinder Block Oil Holes Automatically



▶ Drawing illustrates how vertical, angular, and horizontal air cylinders automatically probe 36 cylinder block oil holes. Collapsing-type probes indicate the exact obstructed oil hole on a master control panel.

● This W. F. & John Barnes Special Automatic Probe Machine, designed and built for a large automobile manufacturer, now test probes 36 cylinder block oil holes for obstructions automatically. The new unit is located in the cylinder block production line just ahead of a bearing cap assembly station. Collapsing-type probes, equipped with microswitches, indicate location of any obstructed holes on a master control panel. Faulty blocks are marked for removal from the Barnes machine and are not allowed to proceed to the next station until the operator clears the master control panel.

This machine is just one of many types designed and built by W. F. & John Barnes to help solve troublesome production problems. Call in a Barnes Process Equipment Engineer today. He'll work with you in developing better cost-cutting methods and equipment.


Probe angular hole at No. 2 and No. 4 main bearing
Probe 2 angular holes in No. 1 and No. 3 main bearings
Probe vertical hole to left-hand oil galleries and vertical hole to No. 4 main web
Probe 4 vertical holes in bearing cap side
Probe horizontal hole at No. 4 main bearing
Probe 45° hole in No. 5 main bearing
Probe compound angle oil gallery hole
Probe 16 valve sleeve lubricating holes and top cover vertical hole to oil gallery

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Write today for your copy of "Coordinated Machine Engineering" describing modern machines and mass production techniques.

W. F. & JOHN BARNES

Special Machine Tools | Special Handling Equipment | Special Electrical Controls

W. F. & JOHN BARNES COMPANY

PROCESS EQUIPMENT DIVISION

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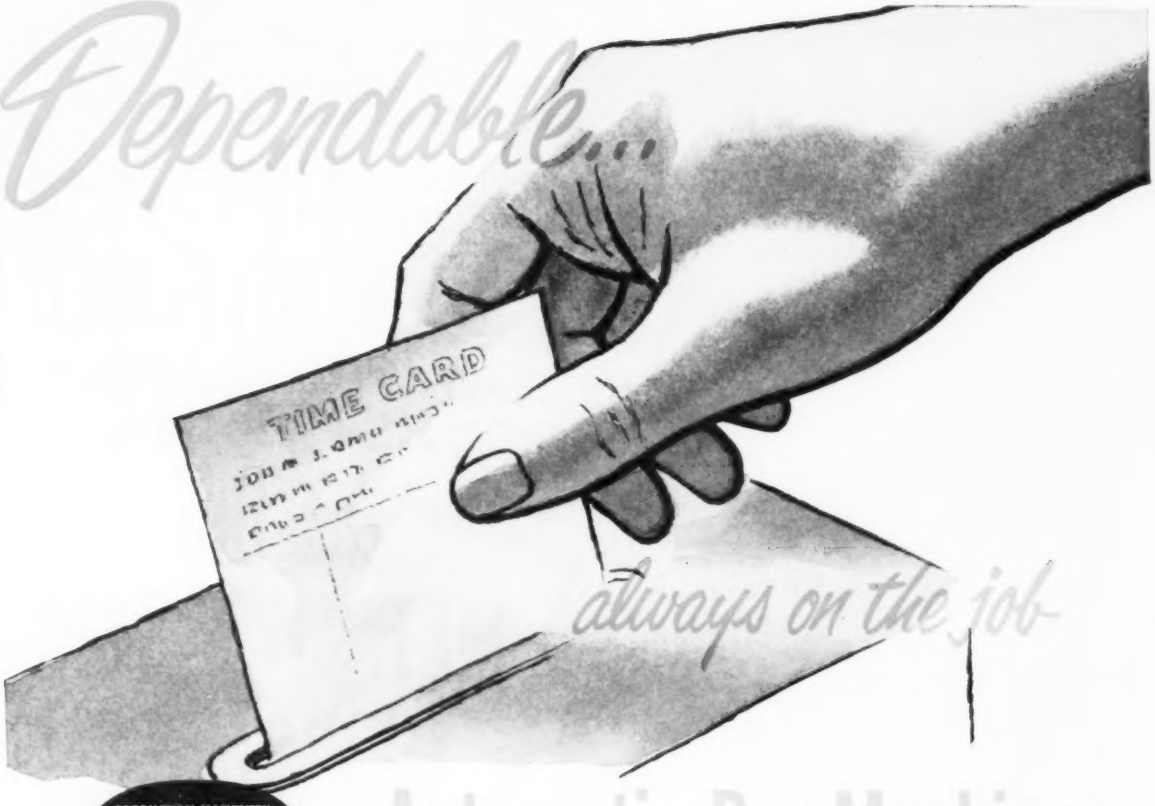
BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1872

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

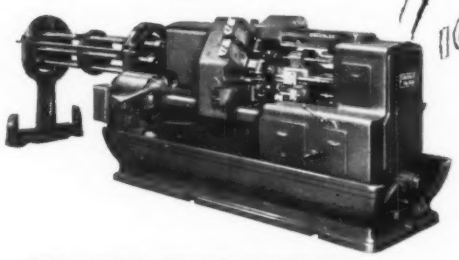
Dependable...



always on the job

PRODUCTION MACHINERY

GREENLEE Automatic Bar Machines



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

BOOST PRODUCTION REDUCE DOWN TIME

It's easy to maintain rigid production schedules . . . prevent costly bottlenecks with Greenlee Bar Automatics. They are always on the job . . . give continuous, reliable service.

You hear much comment about Greenlees' uninterrupted, round-the-clock performance in widely different industries. With good reason, too, for Greenlee offers years of manufacturing experience... plus manufacturing integrity not often duplicated.

Want complete information? Call in the Greenlee man. Let him give you the complete story. Please submit a print when inquiring about a specific job.

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GREENLEE BROS. & CO.

1864 MASON AVENUE

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The ACKNOWLEDGED AUTHORITY of the METALWORKING INDUSTRIES

For forty years . . . through fourteen editions . . . with over a million copies sold, MACHINERY'S HANDBOOK has been the indispensable reference book for designers and builders of mechanical products. Now the 15th Edition, with over 400 pages revised and brought up to date, gives you the latest and most authoritative information on present-day designing, manufacturing and metalworking practices.

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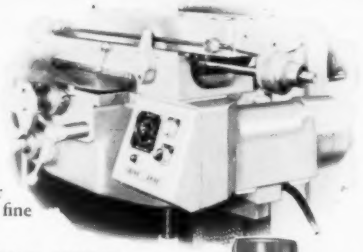
here's why

DYNA-DRIVE
"The Torque-Thinking" Table Feed

"Feels as it feeds"... automatically adjusts for exact amount of torque required. "Thinks while it works", compensates electronically for variations in density, hardness, molecular structure of materials. Result: Superbly fine finish, longer cutter life.

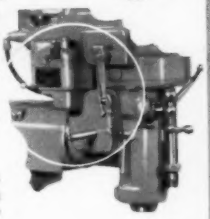


UNIVERSAL SPINDLE HEAD

2 HP dynamically balanced motor with belt and gear train provides wide range of speeds from 80 RPM to 5,600 RPM. Head swivels 90° left or right, head, ram and turret rotate 180°. Cross movement 14 inches. Push button starting.

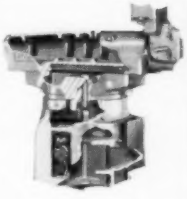
DOWN FEED INFINITELY VARIABLE

Feeds may be varied infinitely from 0" to 5" independent of spindle speeds. High efficiency belt drive. Direction and rate of feed separately controlled.



PERMANENT ACCURACY BUILT-IN

Distortion is prevented by extra heavy one-piece column cast with over-size ribbing . . . extra heavy alloy steel turret clamping bolt (1⅜" dia) with 3-point clamping action . . . heavy dovetail way full length of vertical column face . . . extra large table, knee and 24" saddle (2" longer than table travel) . . . square lock bearings with long, narrow guide between knee and saddle . . . positive locks . . . extra heavy feed screws . . . bearing surfaces hand-scraped.



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Complete Versatility Through Attachments Built-In or Field Installed.

Among such equipment is, Trace-Master Hydraulic Tracer Control, Duplicator Tracer Head and/or Table with base, saddle and table in one unit, 6" Raising Block, End Measuring Rods and Dial Indicators, Self-Contained Coolant System.

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Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A8-1608

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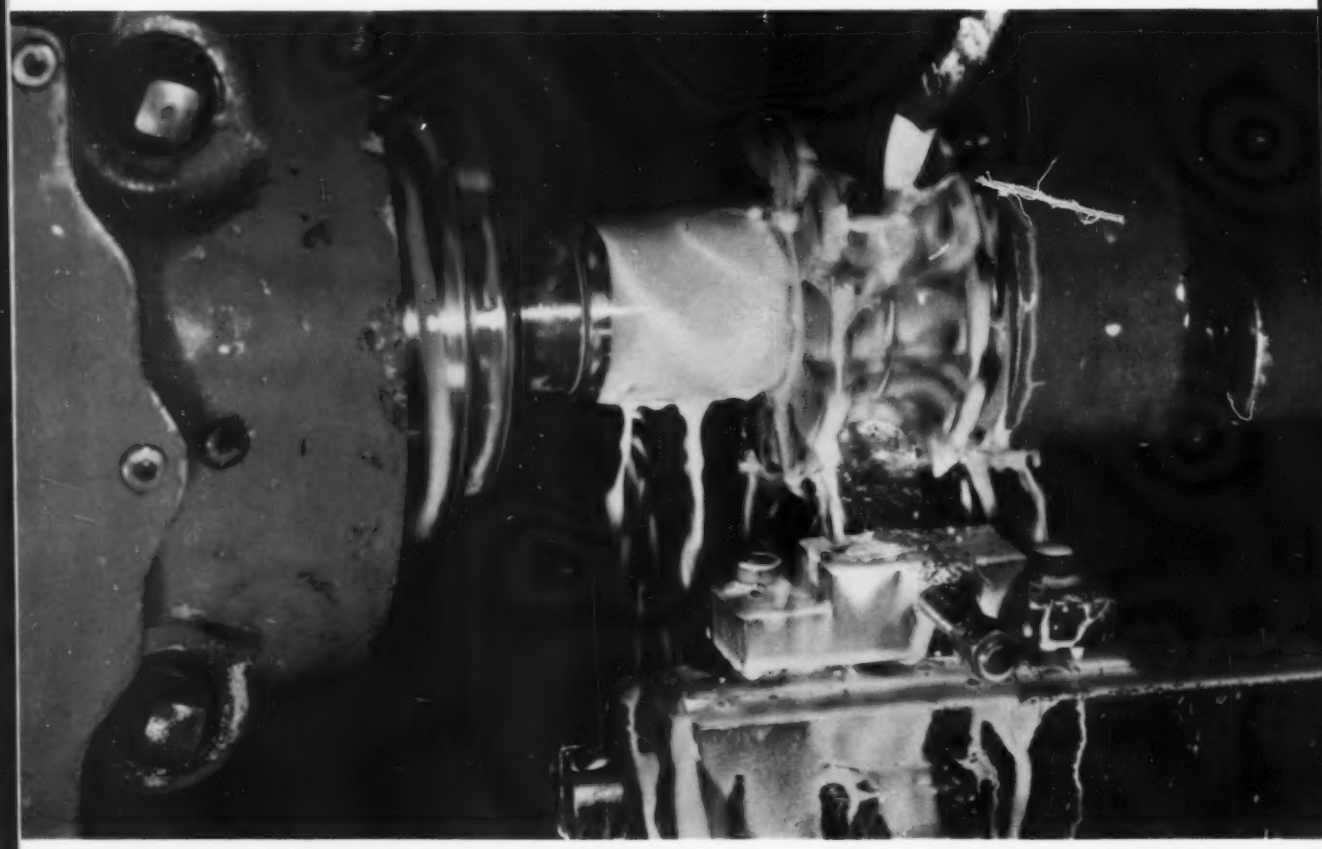
Wheels and machines stay cleaner with emulsions of new S.E.C.O. Also, finishes are better.



Emulsions of new S.E.C.O. allow faster cuts with less tool wear.

Photos courtesy of
Peter Salmon Co., Glenside, Pa.

NEW EMULSIFYING OIL KEEPS MACHINES CLEAN, PROTECTS AGAINST RUST, GIVES IMPROVED HARD-WATER EMULSION STABILITY

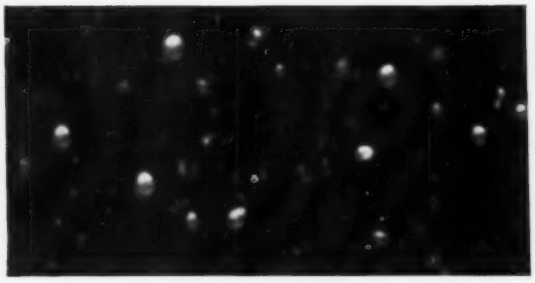
Emulsions of Sun's new S.E.C.O. (Sunoco® Emulsifying Cutting Oil) with smaller oil particle size give you the following benefits—

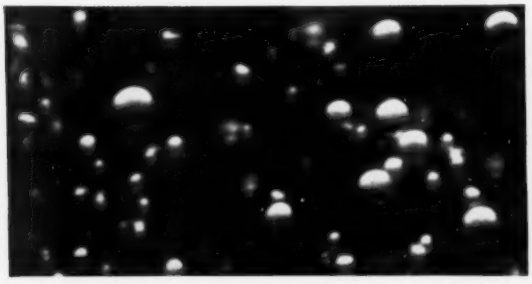
EMULSION STABILITY—In hard-water areas, impartial field tests show that emulsions of *new* S.E.C.O. stand up better under more severe conditions than those made with other regular emulsifying cutting oils.

DETERGENCY—The excellent wetting properties and detergency of *new* S.E.C.O. allow dirt and fines to settle quickly out of emulsions. Grinding wheels and machines stay cleaner.

RUST-PREVENTION—The smaller oil particle size in emulsions of *new* S.E.C.O. gives better metal wetting properties and increased protection against rust and corrosion. See photos below.

If you're a regular user of S.E.C.O., notice how much it has been improved. If you're not, find out what we mean about greater economy and improved production with *new* Sunoco Emulsifying Cutting Oil. Call your Sun representative, or write to Sun Oil Company, Philadelphia 3, Pa., Dept. I-9.





800x photomicrographs of 10% emulsions. *New* S.E.C.O. emulsion on left contains *8 times* as many oil particles per unit volume as ordinary emulsion on right. Many minute particles in S.E.C.O. emulsion do not show at this magnification.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

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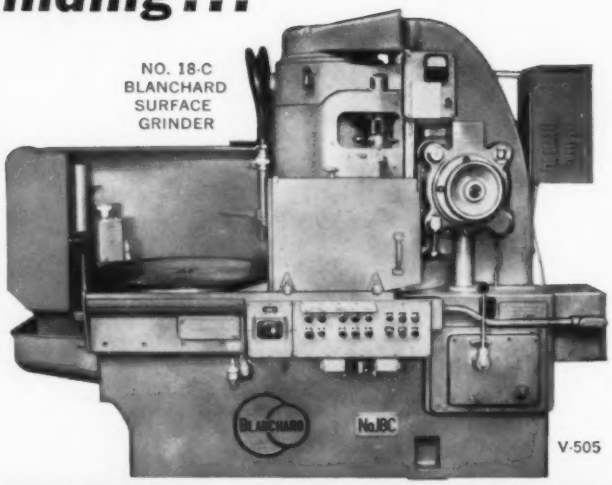
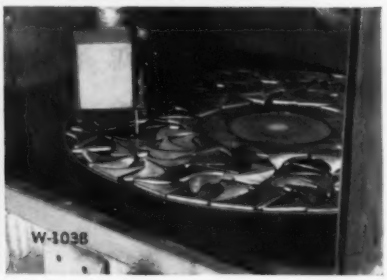
For better, easier grinding...

Whether you're "hogging" off stock from rough castings or precision grinding to a tolerance of ±.0005", you can do it better and easier with the Blanchard No. 18-C Surface Grinder. Once the work is set up, the automatic cycle handles every operation from start to finish. The operator is free to prepare the next load of work or to operate a second No. 18-C Grinder.



Cast Iron Plate. Blanchard ground at the rate of 30 pieces – 60 surfaces – per hour. Stock removal ⅛" each side.

Steel Bars. Blanchard ground at the rate of 48 pieces – 192 surfaces – per hour. Stock .040"-.045" from each side. Limits ±.001" square, flat and parallel.



Hot Rolled Steel Cams. One operator and one No. 18-C Blanchard produce 225 pieces – 450 surfaces – per hour. Stock removal 1/32" each side. Limits ±.001".

just push a button...

- Automatic size control to ±.0005"
- Duplication of repetitive loads
- Pre-set "spark out" time for flatness and surface finish
- No more "operator worry" on close work – greatly reduced fatigue
- A large part of operator's time available for
  (a) Handling or slushing work pieces
  (b) Filing burrs
  (c) Selecting correct wheel and preparing for next job
- Specially-designed sizing device with built-in feature to compensate – automatically – for wheel wear during grinding cycle.

All of these features give you *more efficiency at reduced costs!*

PUT IT ON THE BLANCHARD

Send for your free copy of Model 18-C folder.

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

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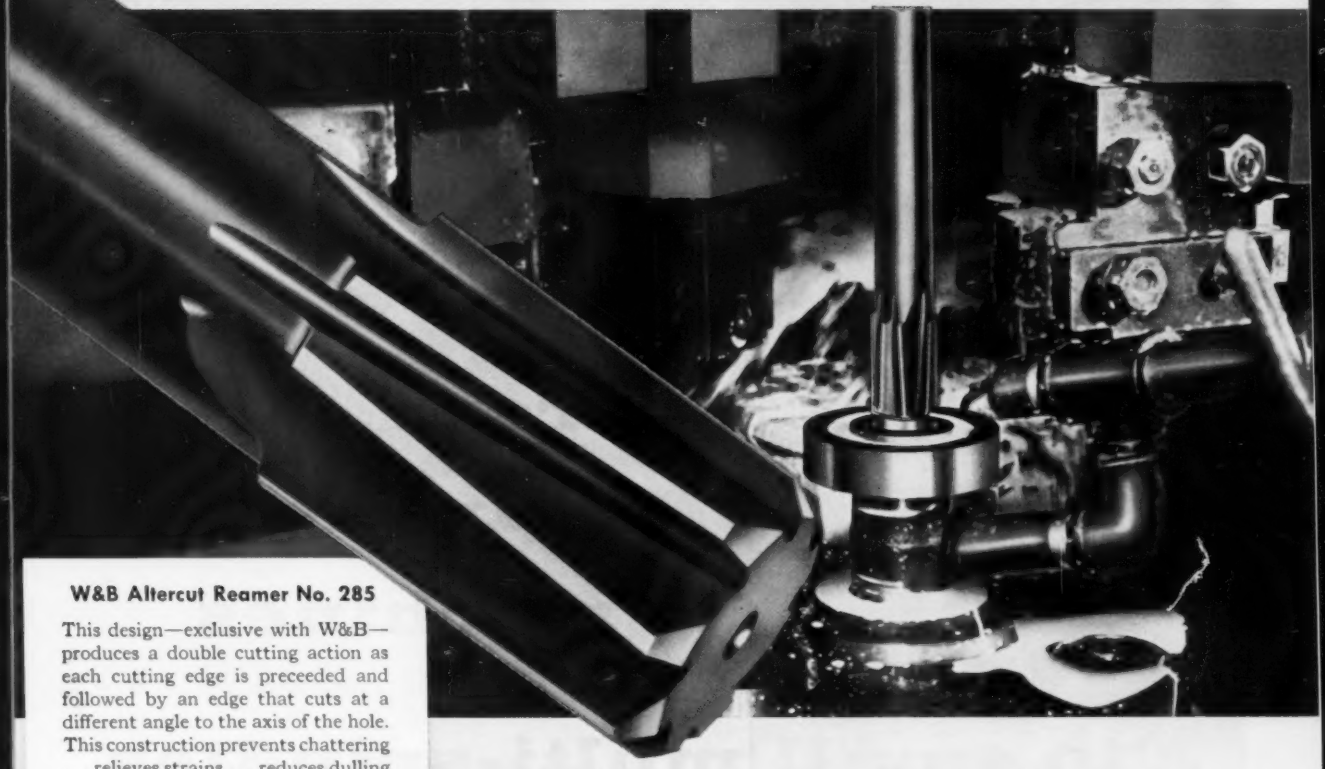
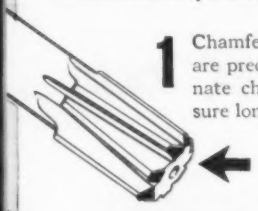
Long range economy PLUS finer finishes
WHITMAN & BARNES REAMERS

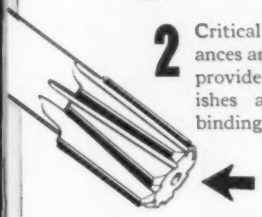


W&B Altercut Reamer No. 285

This design—exclusive with W&B—produces a double cutting action as each cutting edge is preceeded and followed by an edge that cuts at a different angle to the axis of the hole. This construction prevents chattering . . . relieves strains . . . reduces dulling . . . furnishes exceptionally fine finishes.



1 Chamfer relief angles are precise . . . eliminate chatter and assure longer life.



2 Critical land clearances are accurate . . . provide smoother finishes and eliminate binding.

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COUNTERSINKS
COUNTERBORES
CARBIDE TOOLS
SPECIAL TOOLS

FREE Reamer Literature Available . . . write today!

Because reamers are "size" tools, long life is an important money saving factor. Over 100 years of experience enable W&B to design, manufacture and heat treat reamers that produce—consistently—more holes per sharpening. You get better performance plus extra long-life service! W&B's stock line of reamers include types for practically every reaming operation, however, special reamers to your specifications can also be furnished. Check with your Whitman & Barnes distributor today!

Your Industrial Distributor Can Help You . . . With engineering service, recommending the right W&B reamer for your job. With complete in-stock selections of a wide variety of W&B tools. With reliable service and fast delivery on *all* industrial supplies.

INDUSTRIAL DISTRIBUTORS SERVING INDUSTRY ECONOMICALLY THE RIGHT HAND OF PRODUCTION

CALL YOUR WHITMAN & BARNES DISTRIBUTOR TODAY!

WHITMAN & BARNES

"MAKERS OF FINE TOOLS SINCE 1848"

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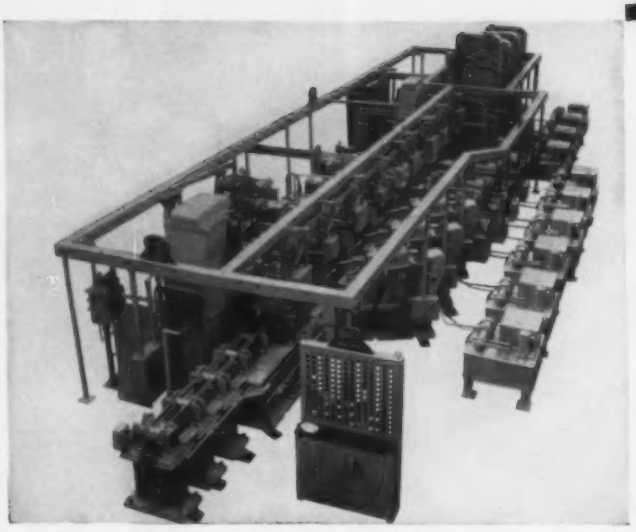
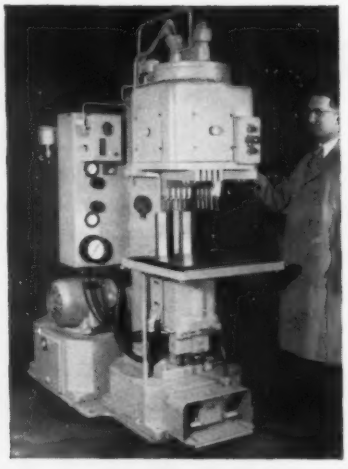
Only Builds



from transfer machines

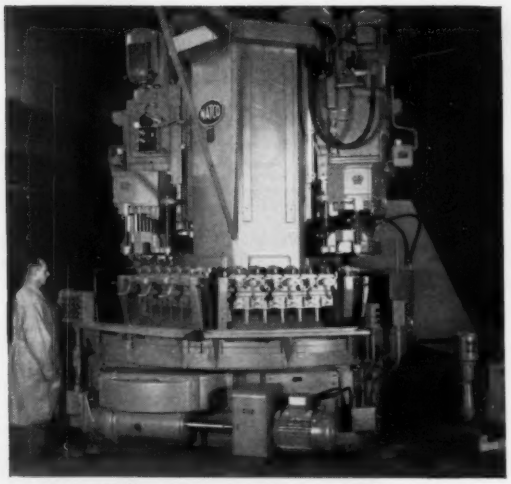
to small multi-spindles



NATCO

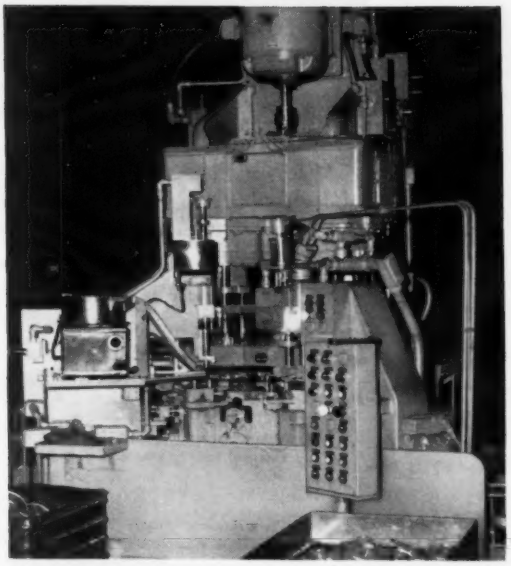
Somewhere in Natco's experience is a money-saving idea for you!

Natco All Six



station

...and everything in between



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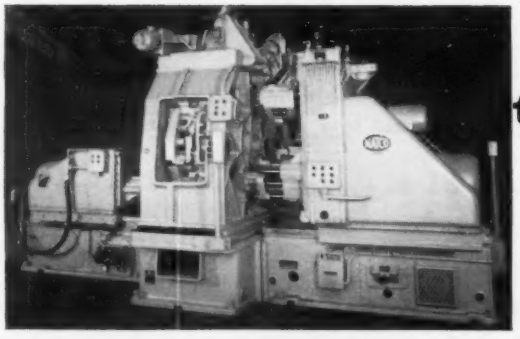
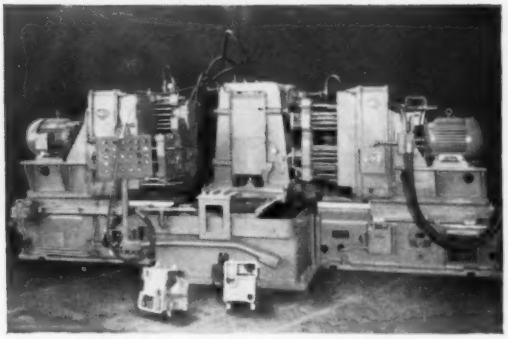


trunnion

way-type



Drilling, boring, facing, tapping.

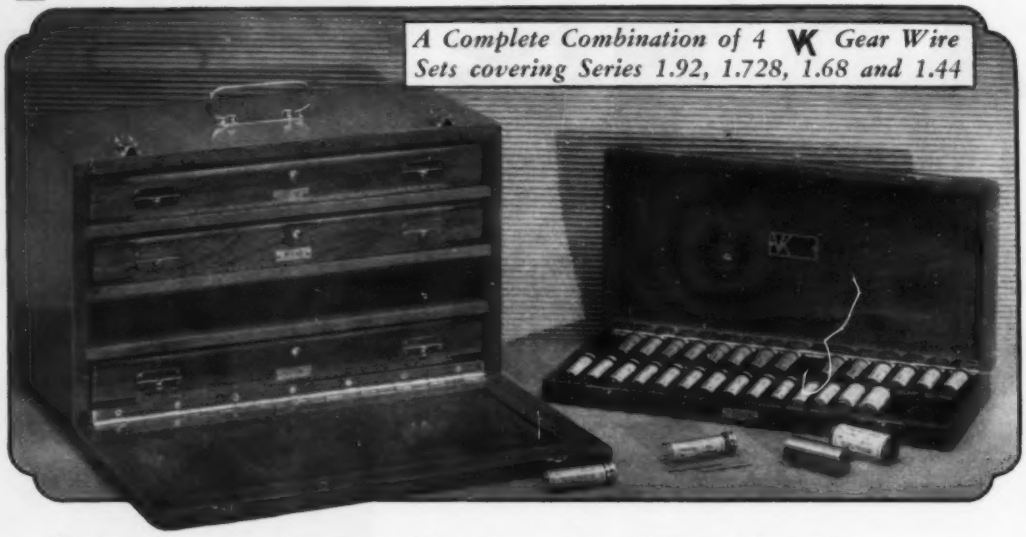
National Automatic Tool Company, Inc.,

Richmond, Indiana. Natco offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland and Los Angeles: distributors in other cities.

For more information fill in page number on Inquiry Card, on page 195

Set No. 84

VK GEAR MEASURING WIRES



Illustrated above is the newest Van Keuren Gear Wire Set No. 84

Set No. 84 is a multi-purpose set designed to cover a range of 26 diametral pitches from 2 to 80 with wires from each of four different and popular wire series:— 1.92, 1.728, 1.68 and 1.44. Because of duplication of wire sizes, this set which would normally involve 104 sizes reduces to 84 sizes. The economy here is evident.

The latest VK Gear Measuring Tables, available in Catalog and Handbook No. 36, have been arranged for use with all four of these gear wire series. Thus the set can be used in conjunction with the tables in many ways, such as:

Tooth Thickness — Measuring *tooth thickness* of internal and external spur gears, splines and serrations.

Involute Profile — Checking *involute profile* by using more than one wire size. Series 1.92, 1.728 and 1.68 for externals. Series 1.68 and 1.44 for internals.

Helical Gears — Measuring *helical gears* when normal diametral pitch is one of the 26 for which the set was designed.

Enlarged Pinions & Reduced Gears — Measuring *enlarged pinions* and *reduced gears*. (tables are now available for the first time in VK Circular G38, giving measurement values and change factors for reduced gears which mate with pinions enlarged in accordance with the latest American Standard covering involute fine pitch gears).

Complete information regarding the use of gear measuring wires is contained in a fifty-page section of the VK Catalog and Handbook No. 36. Included in this section are the most complete gear measuring tables available, as well as all necessary formulas and equations for computing non standard spur and helical gears. Numerical examples are included. This book is available on request.

VK Gear Wires are held within .000025″ for roundness and exact size. Surface finish is 1.5 RMS or better.

If complete coverage of all series is not necessary, sets covering single series such as 26 Ex. or 26 Int. are also available. See Catalog No. 36.

VK

39th YEAR

THE Van Keuren CO.

178 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . .
Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master
Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . .
Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

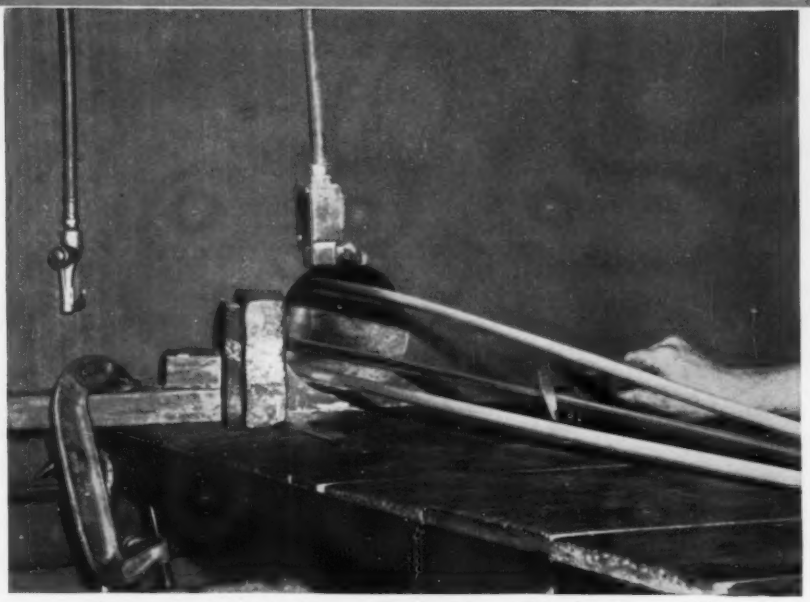
For more information fill in page number on Inquiry Card, on page 195

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Showing extrusions leaving the press. The die of Cromo-WV tool steel is not visible.

Die made from Cromo-WV passes tough extrusion test

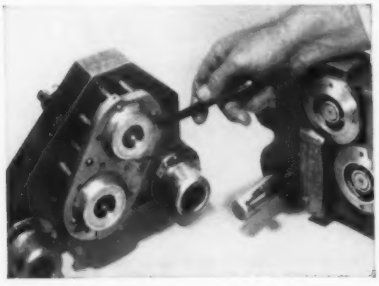
Quality plus economy — that's the kind of a die steel they needed at American Aluminum Extruders, Miami, Fla., to produce aluminum extrusions used as decorative trim. Our local tool steel distributor, J. M. Tull Metal & Supply Co., Inc., recommended Bethlehem Cromo-WV.

"We've had a lot of experience with this grade," they said. "Give it a try, and the performance figures will speak for themselves."

That's just the way it turned out. Cromo-WV was satisfactory in every way. Hardened to Rockwell C-47, the die extruded about 2,500 lb of aluminum before polishing was required.

Cromo-WV, in addition to its 5 pct chrome, contains .30 pct vanadium. It is a modification of our popular Cromo-W, the original 5 pct chrome hot-work steel. Like Cromo-W, it combines red hardness, shock resistance, and resistance to heat-checking. It is an ideal grade for extrusion work.

Your Bethlehem tool steel distributor will be pleased to supply Cromo-WV, whether you want a production quantity or just enough to give it a trial.



IT'S TOPS FOR BOTTLE CAPS

Here's a die made of BTR (Bethlehem Tool Room) which was used in producing millions of tinplate bottle caps. The die was hardened to Rockwell C-61, and was redressed about every third month. BTR is our general-purpose manganese-chromium-tungsten grade of oil-hardening tool steel. Tough, and safe-hardening, you can count on it for extremely long wear.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

In Machining Operations, Chips Tell a Story

A good way to evaluate a machining operation is to examine the chips carefully. This step is particularly valuable in operations where large amounts of metal are removed at high speed.

Generally, the color and shape of the chips tell a story which, when properly interpreted, can lead to improvements in the operation. For example, when machining with high-speed steel tools, the chips produced should show some temper color (yellow or brown). If they do not, it means that speed and feed might be increased greatly, boosting the production rate on the machine. When machining with carbide or ceramic tools, the chips should always be highly temper-colored (purple or blue). If otherwise, you are probably "under-machining."

The shape of the chips will vary with the type of steel being machined, but comparison of chip shape under varying conditions may provide valuable information. The ideal chip shape, indicating ideal machining conditions, is like the letter "C." Often the "C" can have a decided flourish, but this form of chip (on steel) is best. Generally, the secret of producing "C" chips lies in the proper balance of feed and depth of cut, versus speed. These factors should be varied whenever other types of chips are produced, to develop the best machining conditions.

Examination of chip shape is also of value for control purposes. For example, if "C" chips are being produced in a machining operation, and they become gradually longer or stringy, it indicates the tool is becoming dull, and requires resharpening.

It is difficult to establish more specific rules which apply to all machining operations, due to their variety and complexity. However, you can be sure that the proper control of chip color and shape will pay off in increased production.

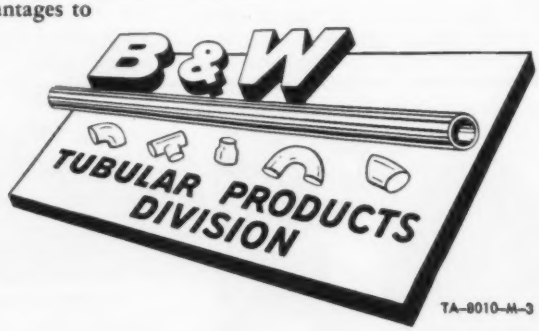
"B&W Tubing

assures easy fabrication–top quality operation for our hydraulic cylinders

As a hydraulic engineer, I'm interested in getting components that cut my fabrication work to a minimum without loss of end-use quality. That's why I always specify B&W Seamless Mechanical Tubing. It's *consistently* of the highest quality . . . and needs very little reworking."

This particular case history, documented in B&W's files, is only one example of the many successful applications of B&W Mechanical Tubing. Because of the high-precision standards to which it is produced, B&W Mechanical Tubing is received from the mill in a condition that often represents 90% of the unit for which it is intended. Advantages to engineers and craftsmen include high strength-to-weight ratio, as well as ability to assume almost any design shape without loss of structural advantages, material, weight and space savings.

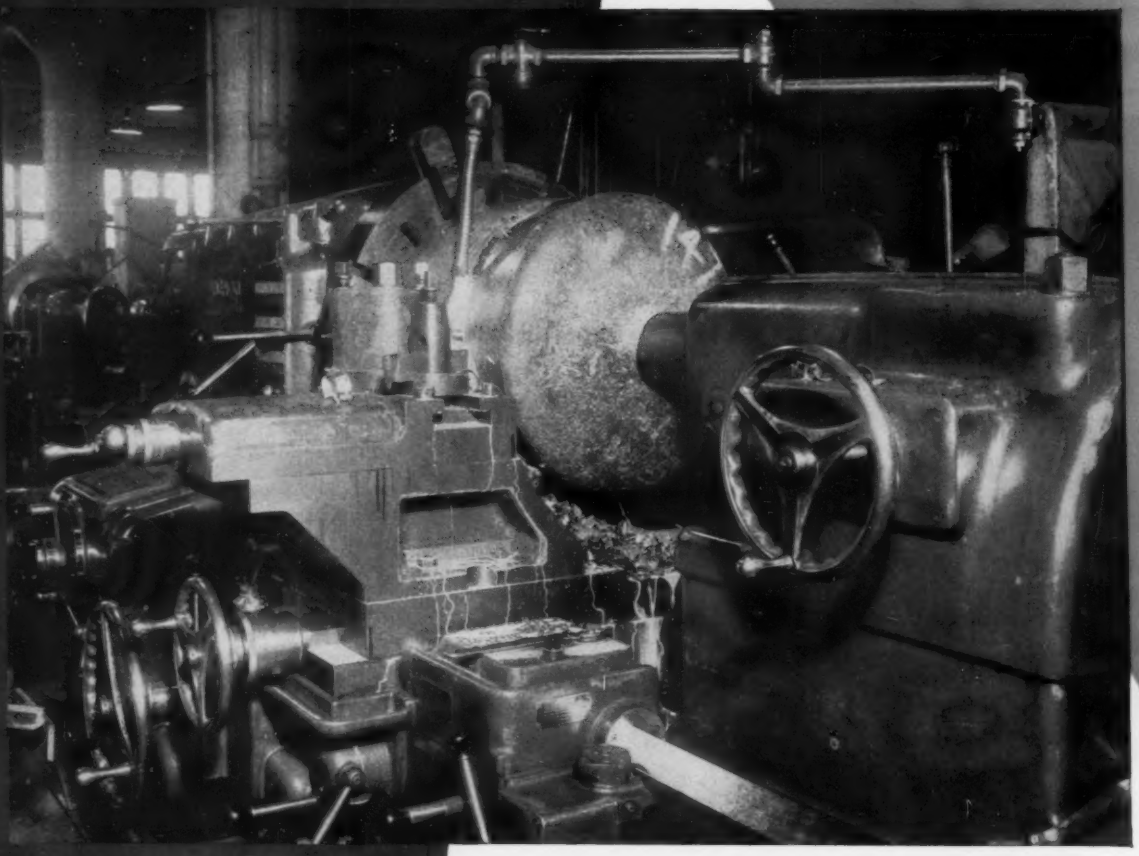
B&W Mechanical Tubing is produced to order, to special sizes, shapes, finishes and analyses and to the mechanical properties needed in the end-use application. Ask for Mr. Tubes, the B&W specialist—he can help you simplify tube fabrication problems—or write for Bulletin TB-361. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.



TA–8010–M–3

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals.

For more information fill in page number on Inquiry Card, on page 195



"AMERICAN"

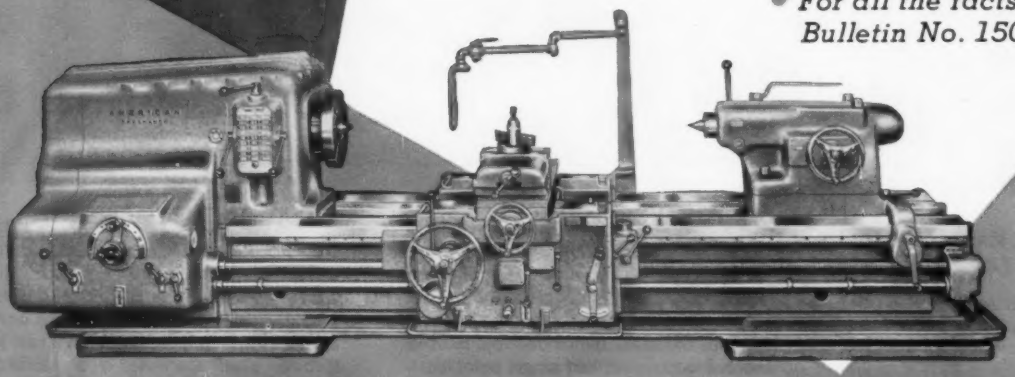
"Scalping" a $12,000 TITANIUM Ingot...

The operation shown by the accompanying illustration is "scalping" (cutting) the hide off of an ingot of pure titanium sponge. The ingot is 25" in diameter and the skin or hide that must be turned off is from ½" to 1" thick.

Due to the terrific cutting resistance of this "hide" low cutting speeds and exceptional ruggedness and rigidity are essential to satisfactory tool life.

Because power, rigidity, ruggedness and inherent stamina are outstanding characteristics of "American" Pacemaker Lathes they have been selected for this severe service by all of the major titanium fabricators.

• *For all the facts ask for Bulletin No. 150.*



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

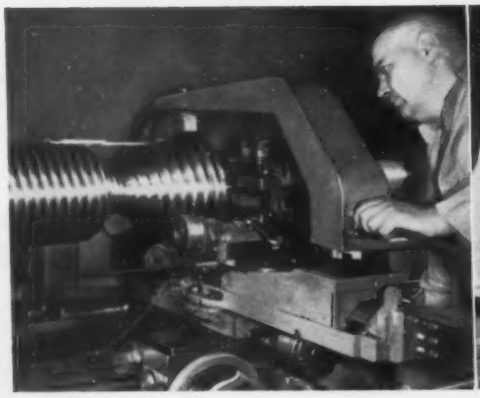
LATHES AND RADIAL DRILLS

till they

RIGHT ON THE NOSE— AND EVERYWHERE!

Grinding complex missile shapes, in many cases, would be either costly, difficult, impossible or all three. Monarch Air-Gage Tracer users produce finishes of 17-18 micro-inches **regularly**—some of which are polished to 2-3 micro inches. Good enough—and no grinding problem! (Above—unretouched photo of die mold for plastic nose cone turned to a 16-18 micro-inch finish)

Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE
FOR A GOOD TURN FASTER . . . TURN TO MONARCH



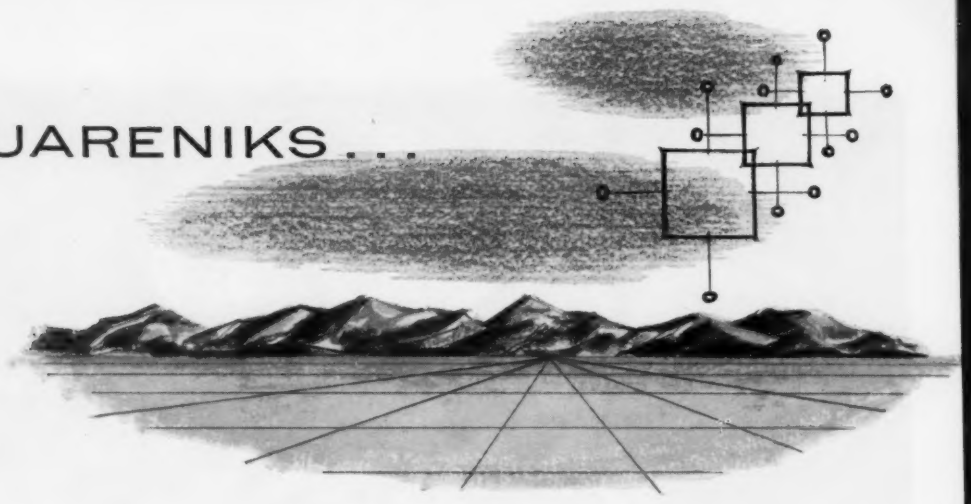
WHAT IT TAKES:

Air-Gage Tracer Control, Swiveling Action—a Monarch exclusive. Only with this equipment can you generate—in a single machining set up—the exacting, complex, often exceedingly thin-walled contours demanded by missile hardware. Tracer-controlled single point turning is mandatory for accuracy needed for critical parallelism, squareness and concentricity—and cheaper, too! (above a helix combustion chamber)

GREAT ON THE FACE OF IT

Numerous Monarch lathes afford you the advantages of constant surface cutting speed—so important to speed and finish in the facing of large, thin-walled work. Shown is a facing operation on a ram-jet turbine disc. Machine is a Monarch Model F Right Angle Lathe, swinging 60" in gap, equipped with Air-Gage Tracer Controls and constant surface cutting speed operating on both sides of center.

want SQUARENIKS...



THE MONARCH SWIVELING AIR-GAGE TRACER

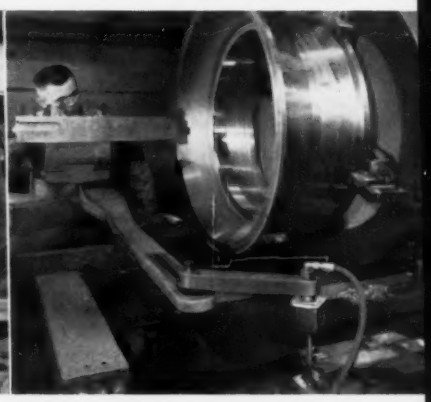
is a missile and rocket making "must"

"Many jobs can be performed satisfactorily only on Monarch swiveling Air-Gage Tracer lathes," says one of the country's leading experts in the field.

Today, missile manufacturing is in its infancy. Even so, Monarch tracer lathes have proved themselves wherever used. And that is in most plants where missile components are being produced. Both swiveling and rigid types are employed. Adaptable to such work are all sizes from the small 10" Model EE to the largest Heavy Duty Lathes, plus the Mona-Matics and the Right Angle Lathe.

Profit by the experience of others. Check the applications pictured and described below. Then ask us for the whole story. Finally, remember we are talking about the same Air-Gage Tracer that is improving production and lowering costs in thousands of plants throughout metal working.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO



SELF-GAGING TURNING!

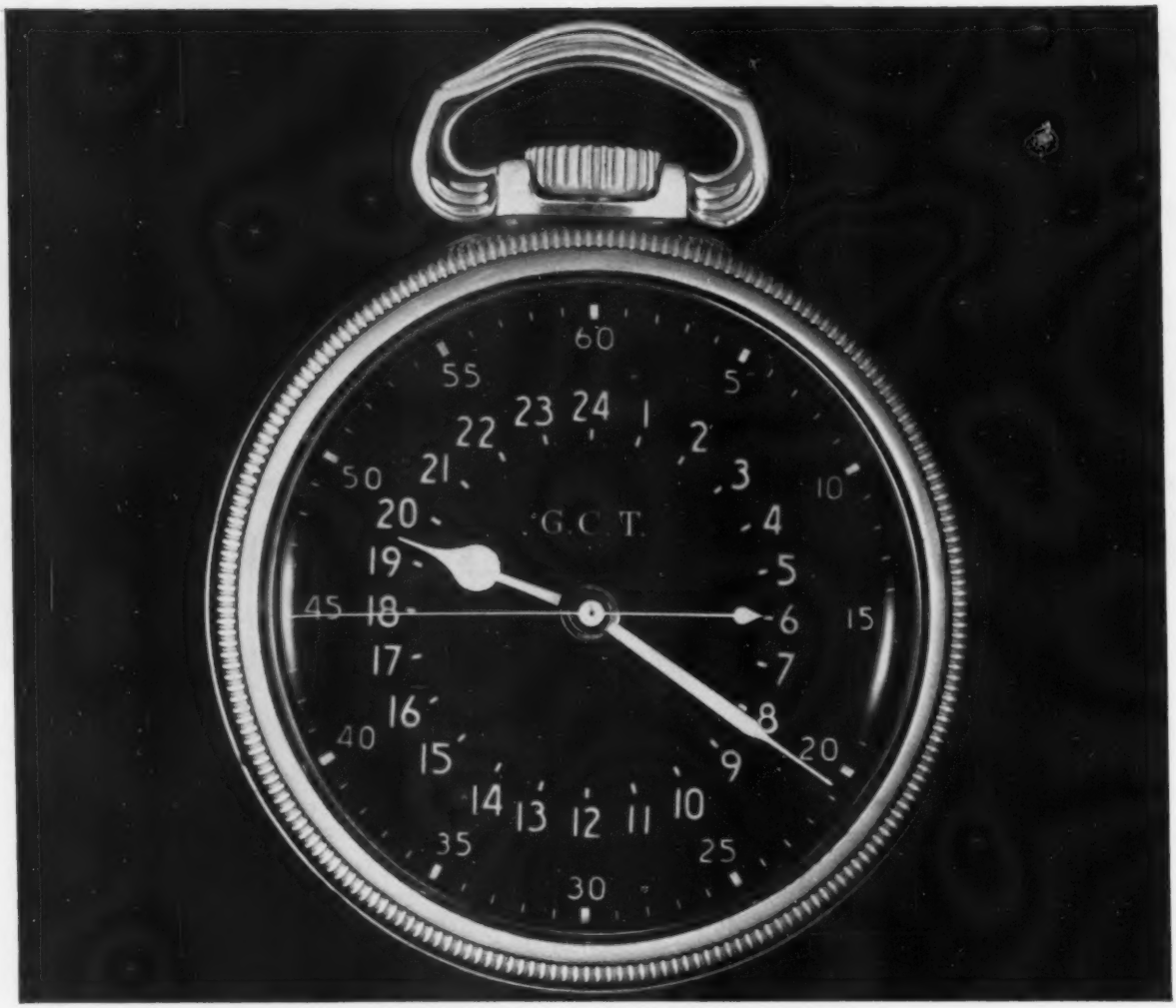
This rocket propellant chamber component is simple compared to some shapes. How's to gage them? Even expensive gaging fixtures can't always fill the bill. So what? With the close repetitive accuracy of Monarch Air-Gage Tracing, intricate parts are accepted based on the accuracy of the flat template used. Light (6-8 oz.) stylus pressure precludes template wear.

MULTI-THOUSAND DOLLAR QUESTIONS—AND EVERY ANSWER RIGHT!

What's to do when you spoil pieces in this business? Especially ones that might cost up in the thousands before machining (Not shown, but we've seen 'em!) Cut your throat? No—rely on the .0001" constant repetitive accuracy of your Air-Gage Tracer slide movement—and don't spoil any!

IT DON'T MEAN A THING IF IT AIN'T GOT THAT SWING

You need size in this business now—and they're designing bigger all the time. That extra-large work can be Air-Gage Traced overall on a Monarch. The turbine housing above is a typical example. But we're not stopping here. **If present Monarch sizes don't meet your actual anticipated needs, let us talk over greater swing designs with you.**



Once around--and we'll have shipped your warehouse order for Timken® 52100 Tubing

THE hour hand on that watch goes around once in twenty-four hours. And before it gets completely around, we can ship your less-than-mill quantity order of Timken® 52100 tubing. We can save you time because we carry 101 sizes of 52100 tubing in our mill warehouse.

And you'll save money, too, with Timken 52100 tubing—by substituting it for costlier alloy steels. You get a steel that's through-hardened in moderate sections, that can be hardened to file hardness or tempered back as you desire.

Many thousands of tons of Timken 52100 have been made into aircraft parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts and precision instruments.

You can rely on Timken 52100 steel. Our rigid quality control assures you uniformity from tube to tube, heat to heat, order to order. We pioneered 52100 tubing in America, and we're the only company that makes 52100 steel in all three products—tubing, bars and wire.

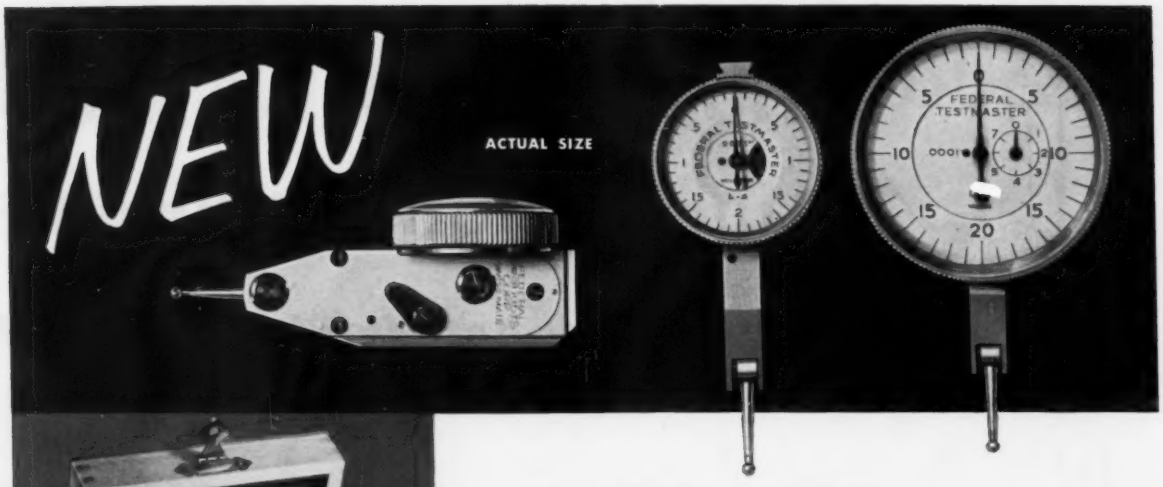
Give us 24 hours and we'll have your Timken 52100 tubing on its way to you. It's available in O.D.'s from 1″ to 10½″ and a wide variety of wall thicknesses. Write, phone or wire: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 195



The long range, high magnification

FEDERAL TESTMASTER

8 new models SWISS MADE to the highest FEDERAL Standards

Now, the most imitated test indicator of all time . . . the Federal Testmaster, adds eight new models to its Series, all made to the highest Federal standards by Swiss craftsmen and all immediately available. These new models, too, will be imitated but never equaled. Beware of look-alikes and imitations.

- These new Federal (Series L) Testmasters have up to *four times the range* you'd expect in a test indicator. The four models with .0005" graduations have .060" range. The other four models (.0001" graduations) have .032" range.
- Despite this longer range, the new .0001" Models have at least *twice the magnification* of other type test indicators. Range per revolution is .004".
- *Even greater magnification* (50% more) if you select the large dial models in this new Testmaster series. They are available in .0001" and .0005" graduations and in regular or perpendicular styles (as are the more compact, smaller dial models).
- Many other features . . . integral dovetails for convenient and positive mounting . . . easy-to-use reversing lever . . . clutch-mounted, interchangeable contact . . . velvet-smooth operation . . . BALL BEARING PIVOTS for low-friction, truly accurate motion transfer.

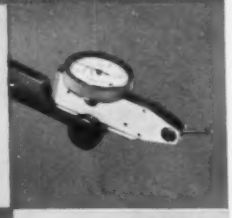
FOR THE WHOLE STORY ON THESE NEW FEDERAL TESTMASTERS ASK FOR BROCHURE.

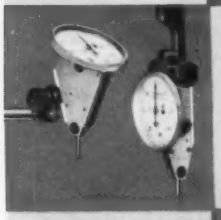
FEDERAL PRODUCTS CORPORATION
8114 Eddy Street, Providence 1, R. I.

Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

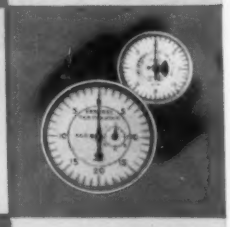
INTEGRAL DOVETAILS make mounting more versatile and secure (An exclusive Federal feature).

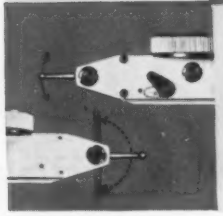




LARGE DIAL MODELS also available in both horizontal and perpendicular styles.

EASY-TO-READ PRECISION DIALS . . . crisp, clear-cut graduations.



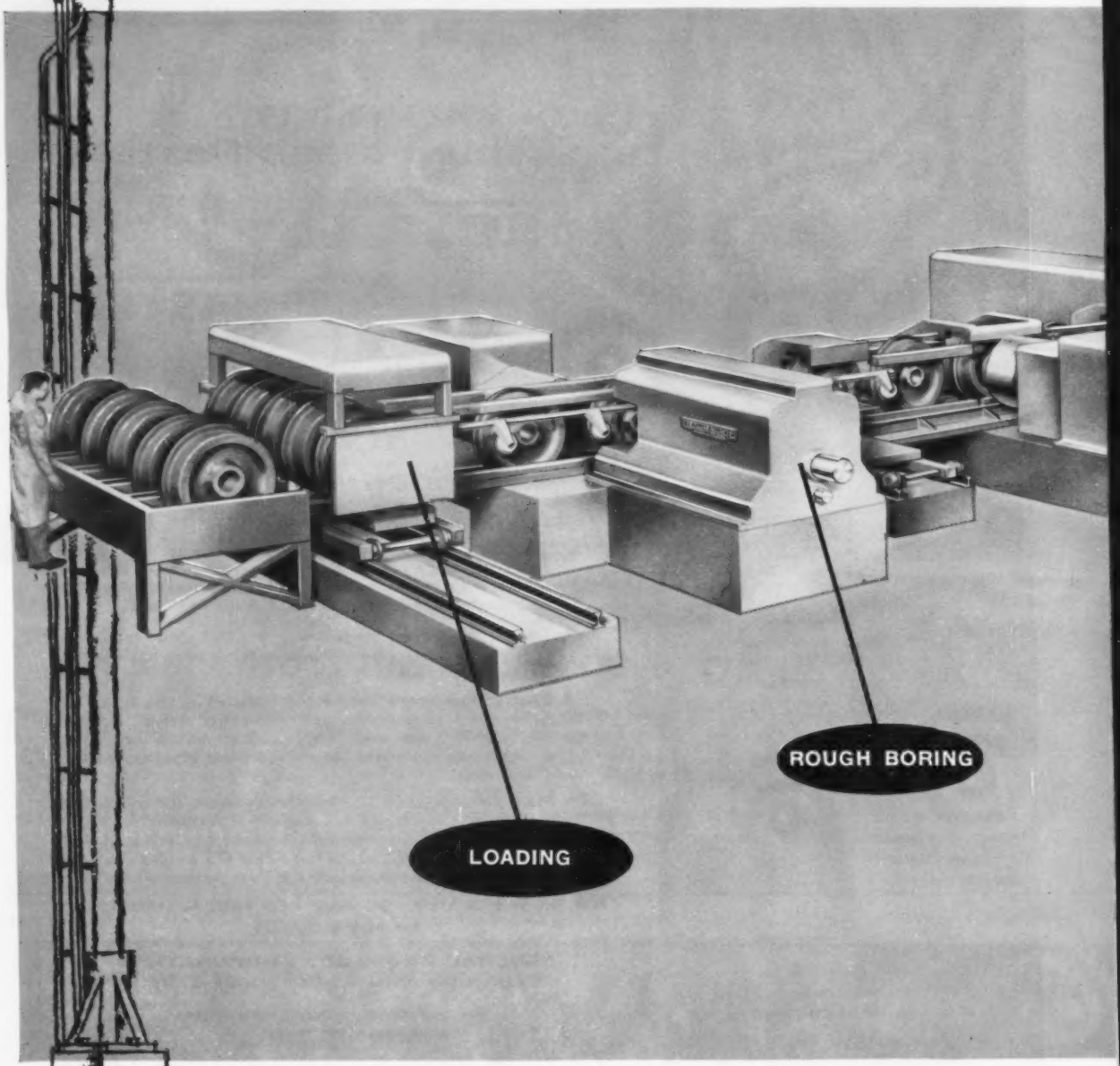


CLUTCH-MOUNTED CONTACT (180° rotation) and easy-to-use REVERSING LEVER.

Another world-wide

Automation of turning

designed to boost freight car wheel



Designers and Builders of Precision and Production

first for Kearney & Trecker

and boring–

production up to 300%

It's a Kearney & Trecker production-engineered 8-station transfer machine.

And it's revising existing concepts of work efficiency and profit potential (on boring, turning, facing and allied operations) at Baldwin-Lima-Hamilton's Standard Steel Works, Burnham, Pa. The automated line of machine tools minimizes handling, produces more uniform, higher precision freight car wheels. The production increase could well reach 300%.

You can expect similar results. Call Kearney & Trecker automation experts now for help with your production machining problems. Kearney & Trecker Corp. 6788 West National Avenue, Milwaukee 14, Wisconsin.

KEARNEY & TRECKER MILWAUKEE ®

Machine Tools Since 1898

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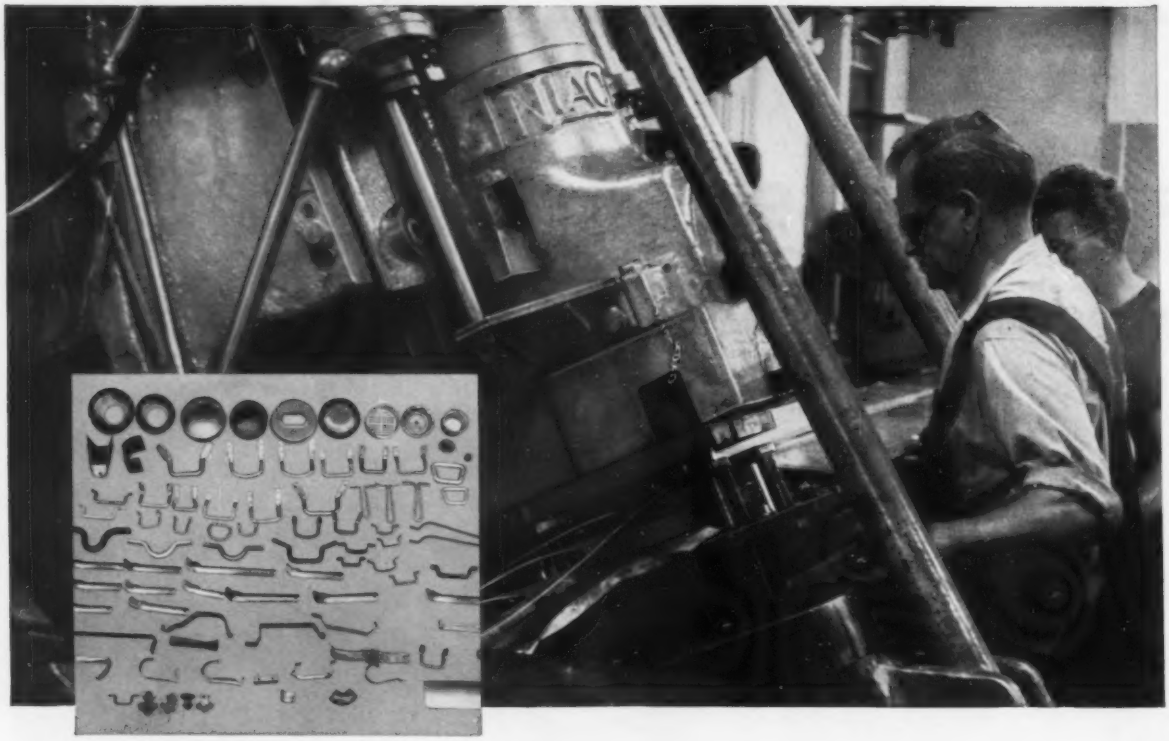


"We stamp them all using just 2 Cities Service Oils!"

...says Res Manufacturing Company Milwaukee, Wisconsin

Presses shift to numerous operations without ever changing oil, thanks to versatility of the 2 Cities Service oils used for all jobs.

Handles by the thousands are produced by Res for cooking utensils and similar items. Finish is excellent, thanks to Cities Service oil.

It's doubtful if anyone makes a more diversified line of stamped and formed metal products than Res Manufacturing Company.

With its 21 presses, ranging from 15 to 200 tons capacity, Res turns out millions of articles a year . . . wire handles, metal handles, wire forms, drawn shells, lifting loops, and parts for electrical controls, to mention just a few.

"All require the best possible finish and all get it with the use of just two Cities Service oils," says Assistant Plant Manager Herbert W. Krueger.

"For drawing, shaping, and punching aluminum, we use Cities Service Chillo #2 with excellent results. Where drawing, swedging or forming of steel and brass is required, we use Cities Service Chillo 12 and get equally fine results.

"Not only do these two Cities Service oils handle all our jobs and produce the best possible finish, but we also find they increase tool life and hold scrap to a minimum. In short, these are the best oils we have ever seen."

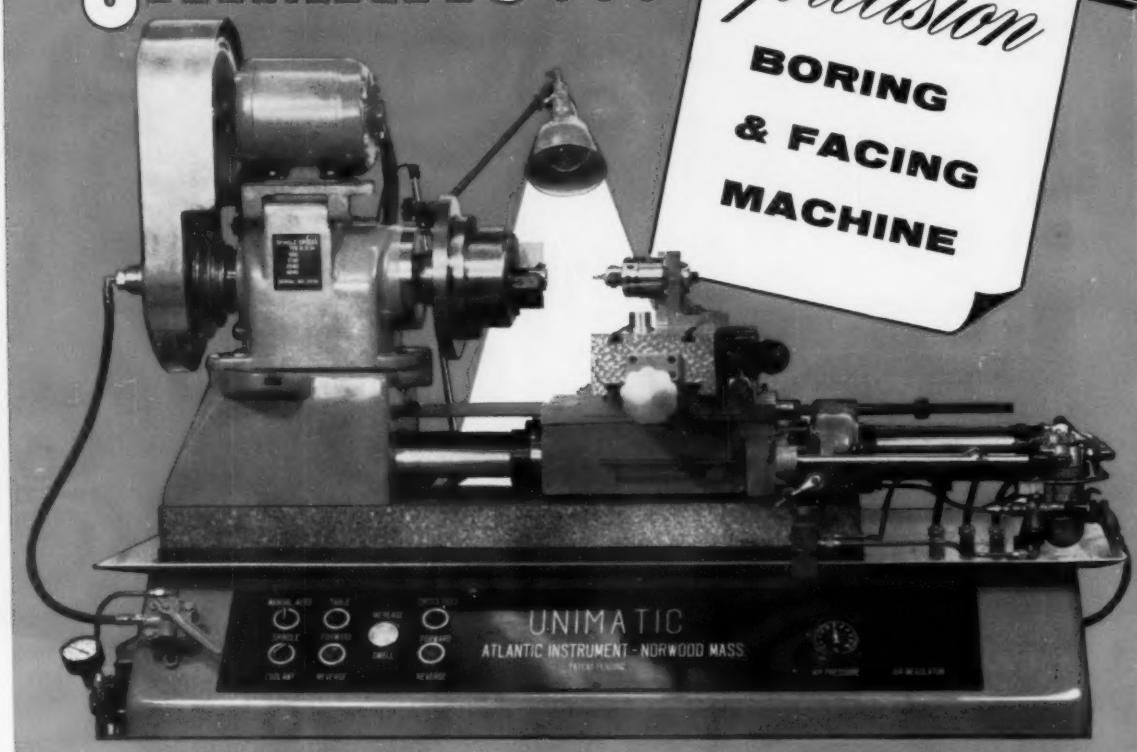
Like Res Manufacturing, chances are your operation can be simplified with the right Cities Service oils. Talk with a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

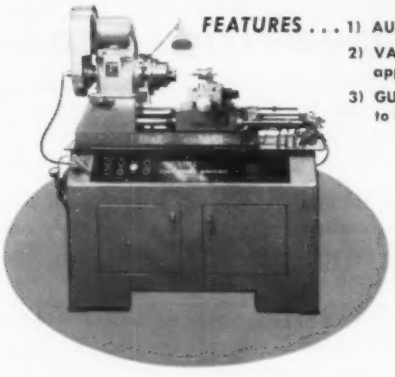
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

UNIMATIC...

HIGH *precision* BORING & FACING MACHINE





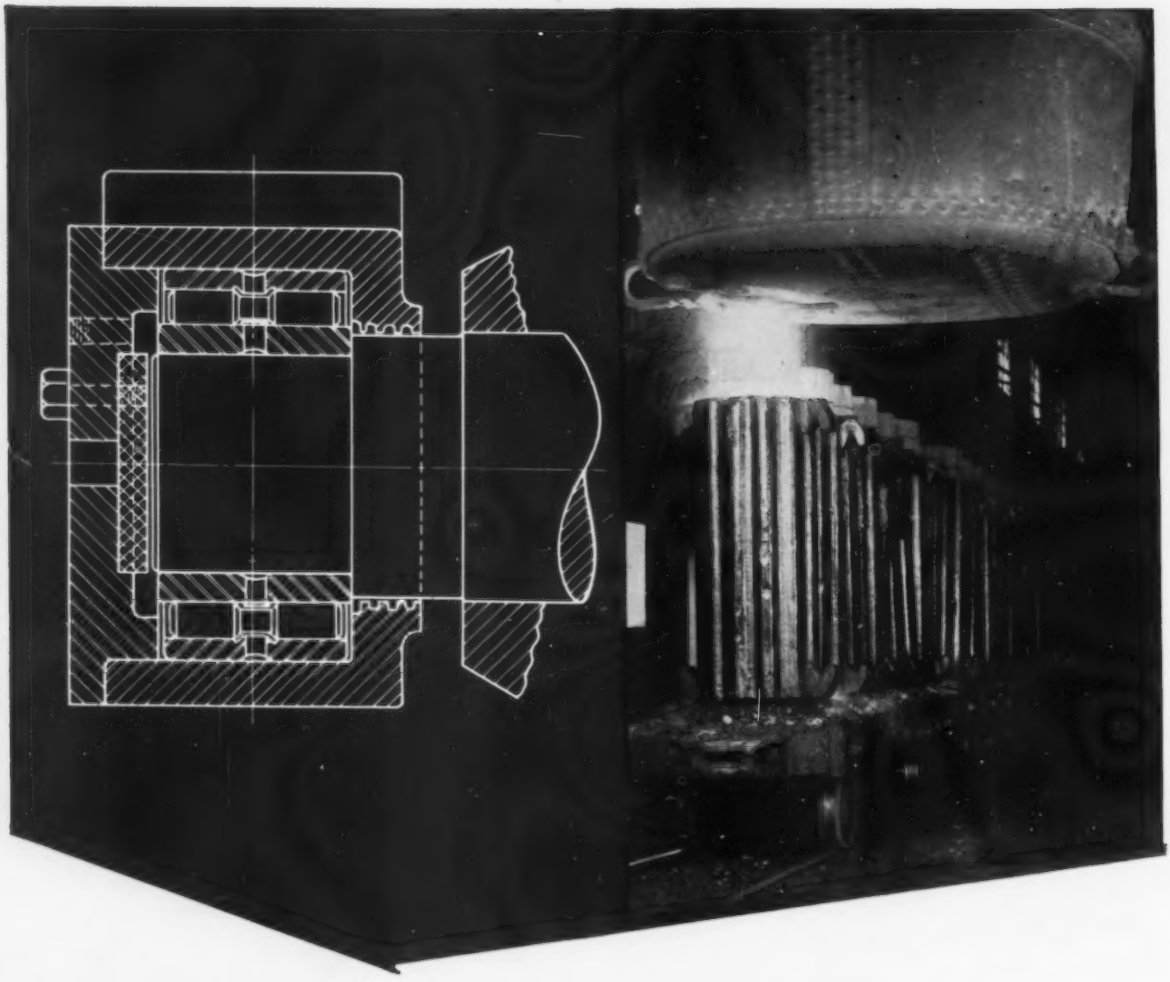
FEATURES . . . 1) **AUTOMATIC CYCLING**
2) **VARIABLE FEED** approaches and returns
3) **GUARANTEED** to hold work to .0002"

Designed and built by ATLANTIC INSTRUMENT COMPANY for their own use . . . and now offered as a type and size of machine for which there is a strong demand, especially in the instrument and allied industries, where close tolerances must be held.

The UNIMATIC *comprises an extremely accurate machine element, mounted on a granite base scraped to a tolerance of .00005", with other features (fully explained in our catalog) neutralizing the effects of temperature variations.*

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



Bearings, Inc. engineering service . . . solves another bearing problem

Ingot mold cars for a large tube mill were continually out of service due to the short life of babbitt, bronze or other bearings originally supplied in the cars.

The Trouble? Bearings, Inc. engineers found shock loads far beyond the capacities of the original bearings. Extreme wear on bearings due to excessive skewing, bent axles and uneven track.

The Answer. Shown above is the Bearings, Inc. drawing of the installation that replaced the original bearings. It has greatly increased load capacity and no dimensional change is required in the shaft or bearing housing.

The Result. The new bearing is designed on a new principle that keeps rollers in line and eliminates skewing. Shock loads due to uneven tracks have little effect on our installation for its construction makes possible a greater number of rollers available to support the load at all times.

This is just one of the many such problems we have solved for our customers. In all cases we supply only bearings we are authorized to distribute. They are new and come to you fresh in the manufacturers' boxes.

If you have a bearing problem or need replacement bearings in a hurry — call or write our branch nearest you, they're ready to give fast service.

Providing bearing service in the North ➤ **BEARINGS, INC.**

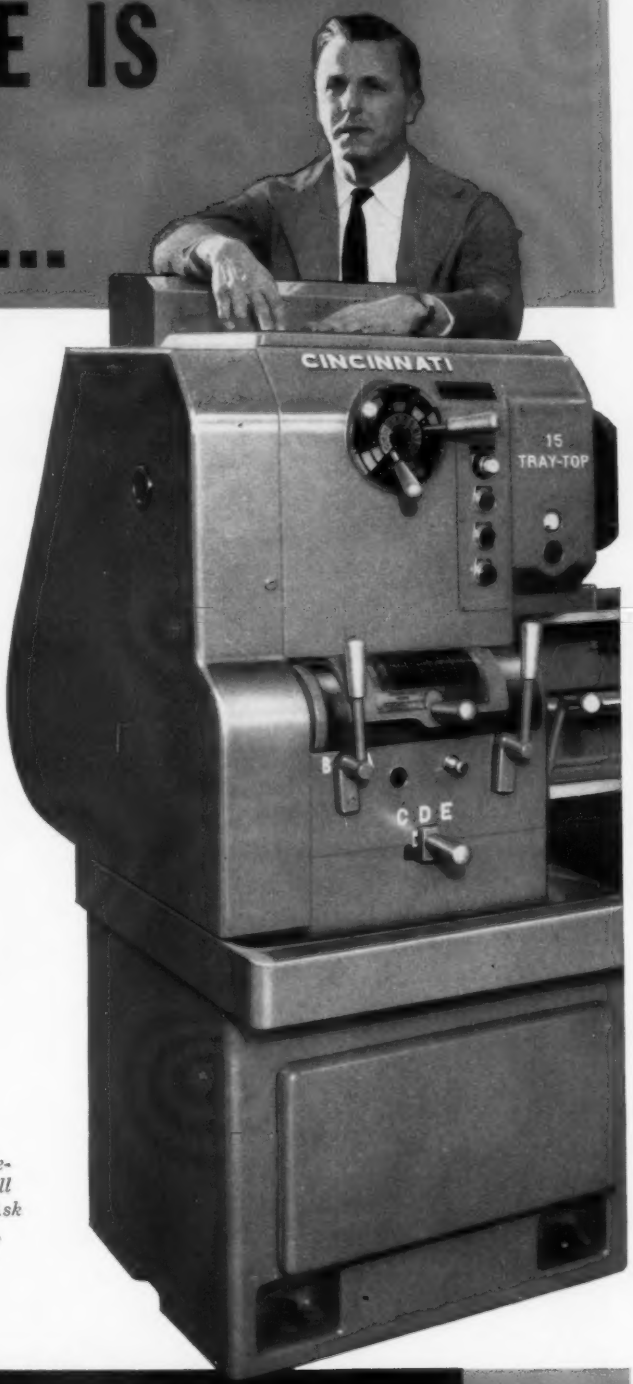
OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
NEW YORK: Buffalo, Bolanrol Corp. • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and

in the South ➤ **DIXIE BEARINGS** *INCORPORATED*

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans
N. CAROLINA: Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville

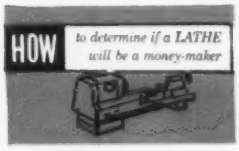
THIS LATHE IS WORTH MORE...



It gives lower production costs, less downtime, fewer rejects. And economy-priced Cincinnati Tray-Tops are husky and versatile enough to handle some of the jobs that often tie up heavy duty machines.

Wide spindle speed range in geometric progression provides the right speed for every job; *full feed range* meets all roughing and finishing needs; *control convenience* affords minimum operator effort with maximum safety; *rugged construction* assures maintained accuracy and lowest maintenance costs.

Do You Have Your Copy of This Booklet?



It tells you how to determine if a lathe will be a money-maker. Ask your C L & T Dealer, or write us direct.

Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

LET MAGNA repeat these savings

VISIT CP BOOTH 1804
See These Tools In Action:
- Torque Control Tools (Cam-fork and Magnamatic)
- Broaching
- Multi-spindle

Breakage of plastic handles was spiralling assembly costs at the Line Material Industries, Zanesville, Ohio. The culprit—overtightened screws which caused a large number of handles to hit the scrap bin daily.

A CP Magnamatic screwdriver was installed in September 1956 and has been saving this company over $2000 a year in spoilage alone. Assembly time has been cut by 12%. The Magnamatic One-Shot Clutch runs each screw to the exact pre-set torque then "shifts to neutral"—virtually eliminating breakage. There's no ratcheting, burred screw heads or damaged work. And the uniformity of the Magnamatic's precision tightening action provides a final product inspection that assures complete quality control... eliminates any need for final hand torquing.

Get the facts first hand! Mail the coupon today for prompt action or detailed information!

MATIC
in your plant!

Chicago Pneumatic

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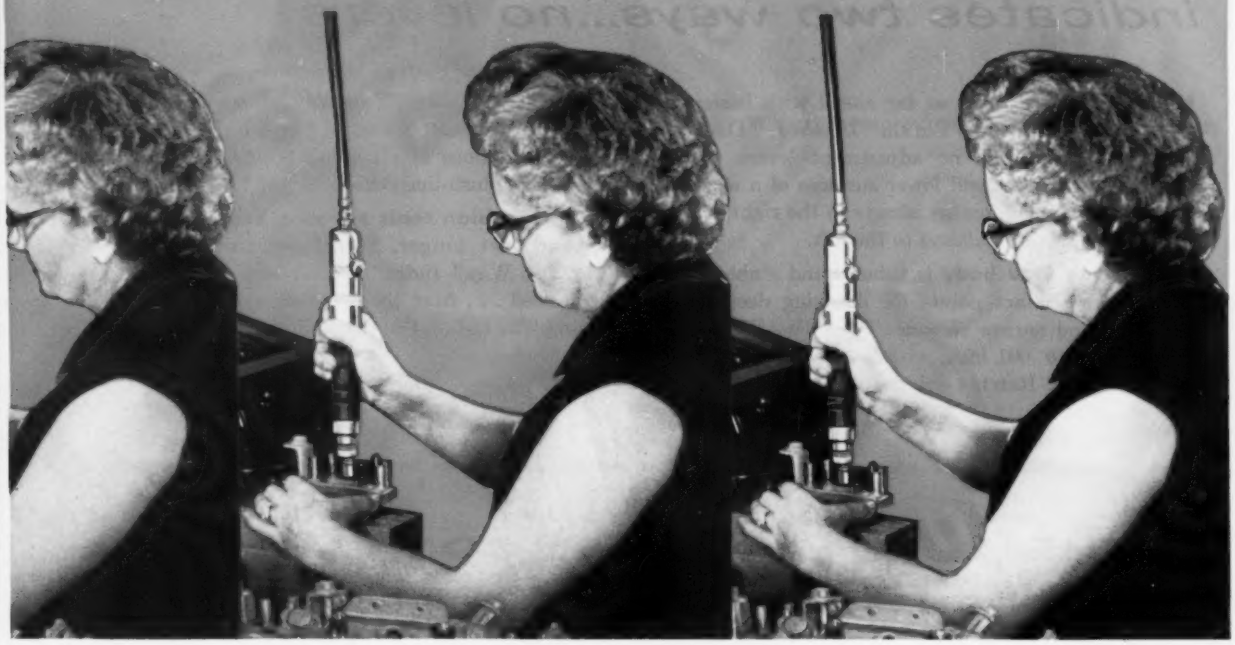

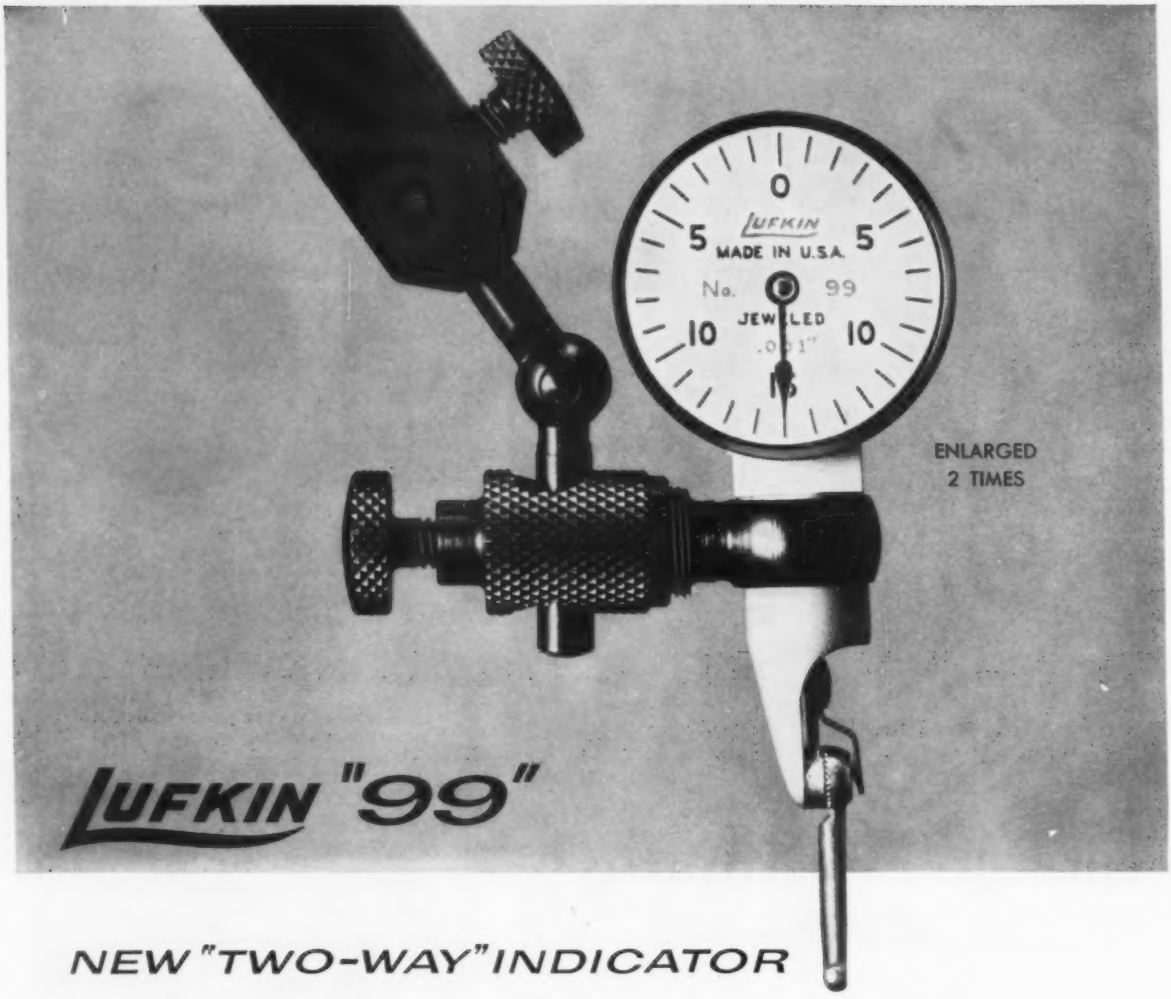

NEW "TWO-WAY" INDICATOR

indicates two ways...no levers

No other indicator is so far ahead with basic improvements. This new Lufkin "Two-Way" Dial Test Indicator needs no adjustment levers to indicate both upper and lower surfaces of a slot or recess. Plus readings are *always* to the right of zero; minus readings *always* to the left.

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All Lufkin precision tools are easier and faster to use and last longer. So choose the new Lufkin "Two-Way" Indicator . . . and all the tools you need . . . from the complete up-to-date Lufkin line. The Lufkin Rule Company, Saginaw, Michigan.

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TAPES • RULES • PRECISION TOOLS

For more information fill in page number on Inquiry Card, on page 195

THEY *get to take a last look inside*

Standard Oil research develops method for inspecting lubrication of enclosed parts without disassembling

What if you had to make a final inspection of enclosed parts to be sure they were lubricated and you could not do it without disassembling? Standard Oil research scientists have just developed an instrument system that determines lubricant level in an instant. The device measures the density of an assembly so precisely the presence or absence of the desired quantity of lubricant registers on a meter.

Having such a unit might permit you to shorten an assembly line or reorganize assembly operations for greater convenience, speed, economy. The research men at Standard who developed this inspection method will be glad to share their know-how with you to help you fit it to your assembly operations.

This is the research pay-out you get from Standard. This is the "something more" Standard gives to industry besides the research which has established Standard Oil petroleum products as the industry criteria for quality.

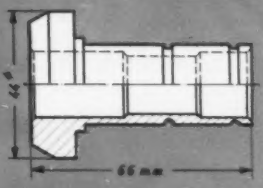
For more information about this development or for assistance on other lubrication problems, inquire of any of the 48 Standard Oil district offices in the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

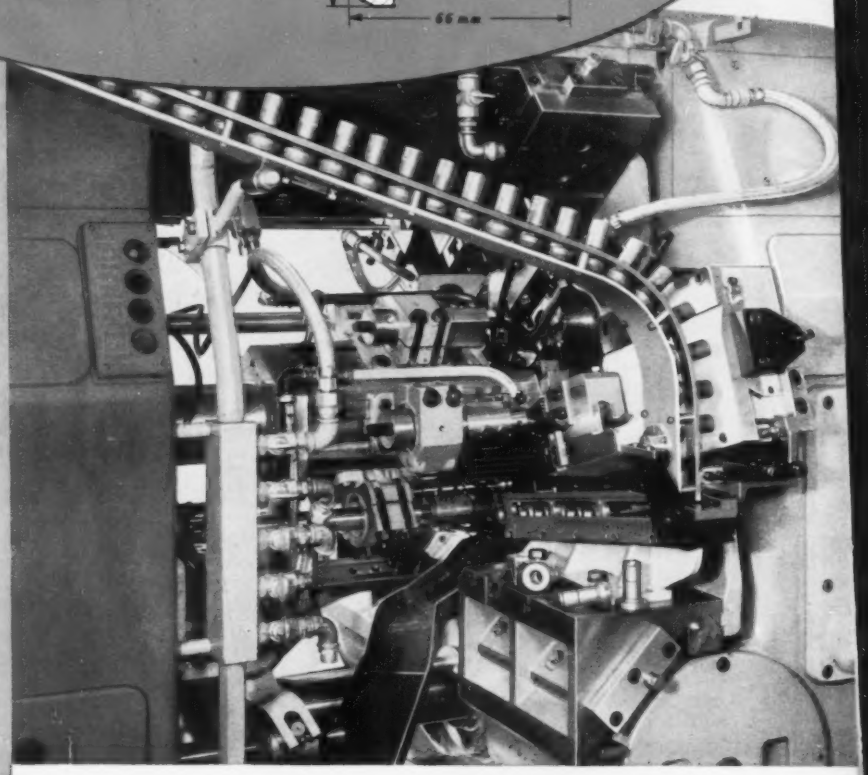
You expect more from **STANDARD** *and get it!*

All 'round the world.

HOW ACME-GRIDLEY BASIC DESIGN SAVES TIME IN GERMANY

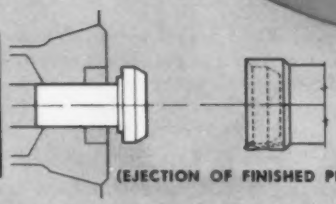
Automotive sleeve produced in West Germany on a German-built 6 Spindle Acme-Gridley Automatic. Machining is performed in 27.3 seconds, a saving of 30.8% of the time used by previous methods.





RÜCKANSICHT MIT MAGAZIN EINRICHTUNG
REAR VIEW WITH MAGAZINE LOADING ATTACHMENT

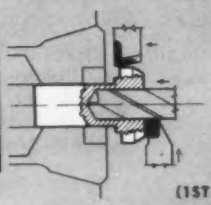
6TH POSITION



(EJECTION OF FINISHED PIECE)

MAGAZINE LOAD (1ST OPERATION)

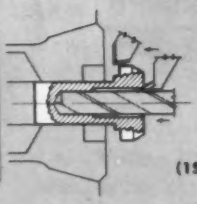
1ST POSITION



(1ST OPERATION)

ROUGH TURN HEAD
FACE
DRILL LARGE HOLE

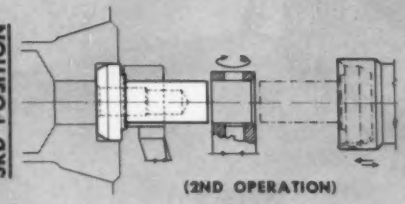
2ND POSITION



(1ST OPERATION)

FINISH TURN HEAD
CHAMFER INNER DIAMETER
DRILL SMALL HOLE

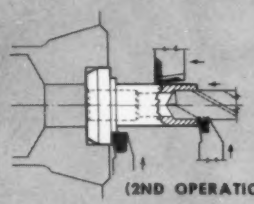
3RD POSITION



(2ND OPERATION)

TURN OVER AND RELOAD

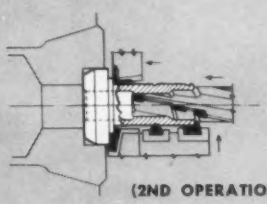
4TH POSITION



(2ND OPERATION)

TURN SHANK DIAMETER PARTWAY
FACE BACK OF HEAD
FACE END OF SHANK • DRILL

5TH POSITION



(2ND OPERATION)

TURN SHANK DIAMETER REMAINDER • FINISH FORM COLLAR BACK OF HEAD AND GROOVES • FINISH DRILL TWO DIAMETERS WITH STEP DRILL

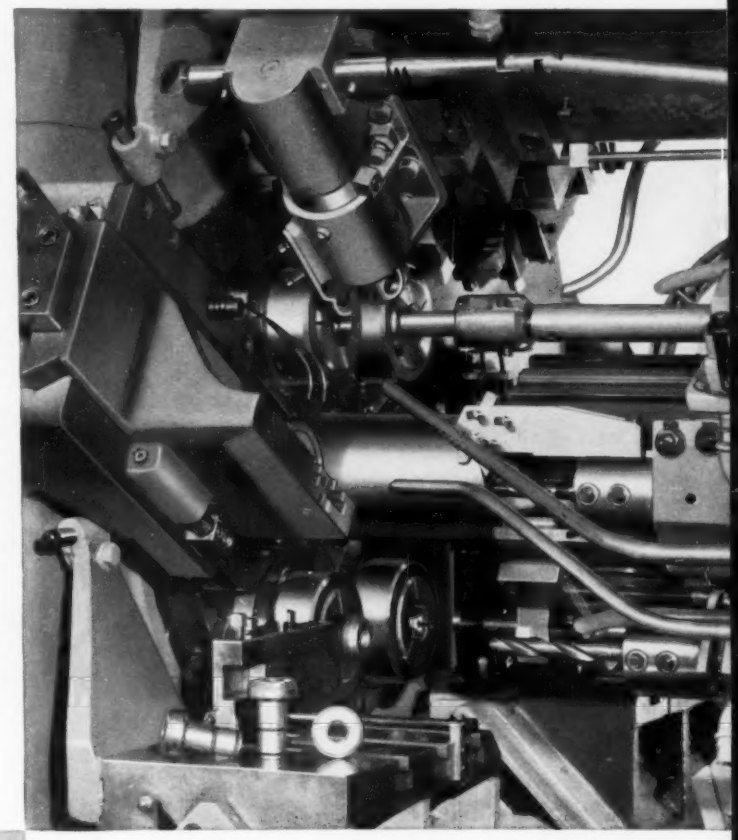
. . . where there's work to be done and time to be saved . . .

there's an Acme-Gridley to do it!

In the metal working plants of Essen and Hamburg you'll often hear the phrase ***Schnellste Automatiche Fertigung.*** Chances are, ***mit Acme-Gridleys,*** is added for ***Schnellste Automatiche Fertigung*** means high speed automatic production and all 'round the world the use of Acme-Gridley Automatics results in high speed production ***and*** greater precision in metal working.

The illustrations show the production of an automotive sleeve which is tooled from an upset forged blank fed into the German built Acme-Gridley by a magazine loading attachment. After one end of the part is machined it is turned end-for-end by a special attachment and then the other end machined—the part completely finished.

This high speed—high quality production is typical of the way Acme-Gridley circumferential automation makes things faster—better—cheaper—all 'round the world. That's why we say "When there's work to be done and time to be saved, there's an Acme-Gridley to do it".



WENDE EINRICHTUNG LAGE 3
TURNING ATTACHMENT POSITION 3

why don't you
INDEX . . . to lower machining costs . . . with *Acme-Gridley*
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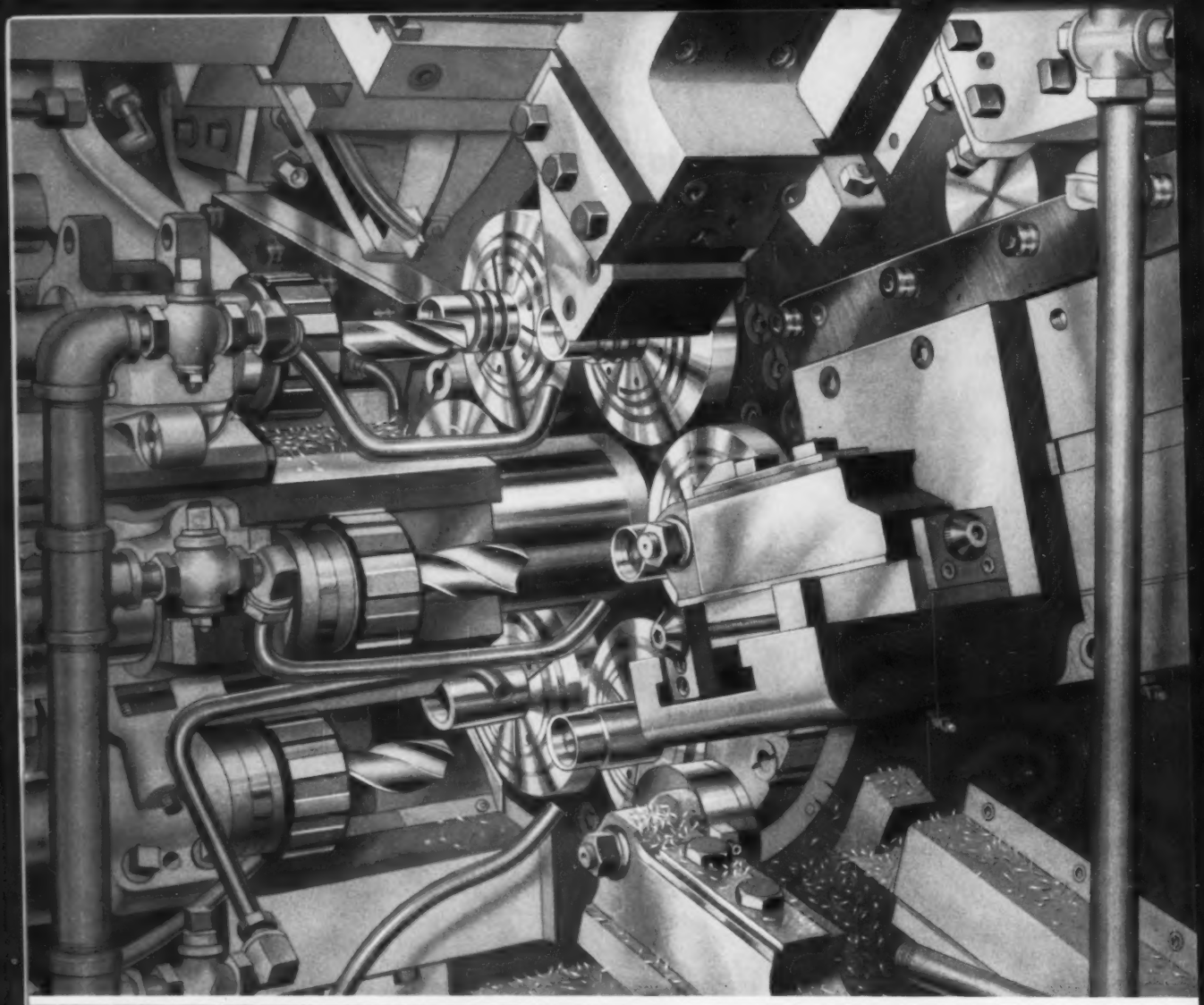
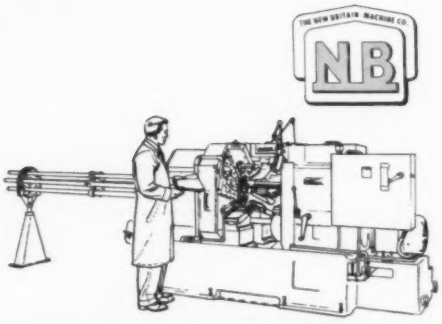
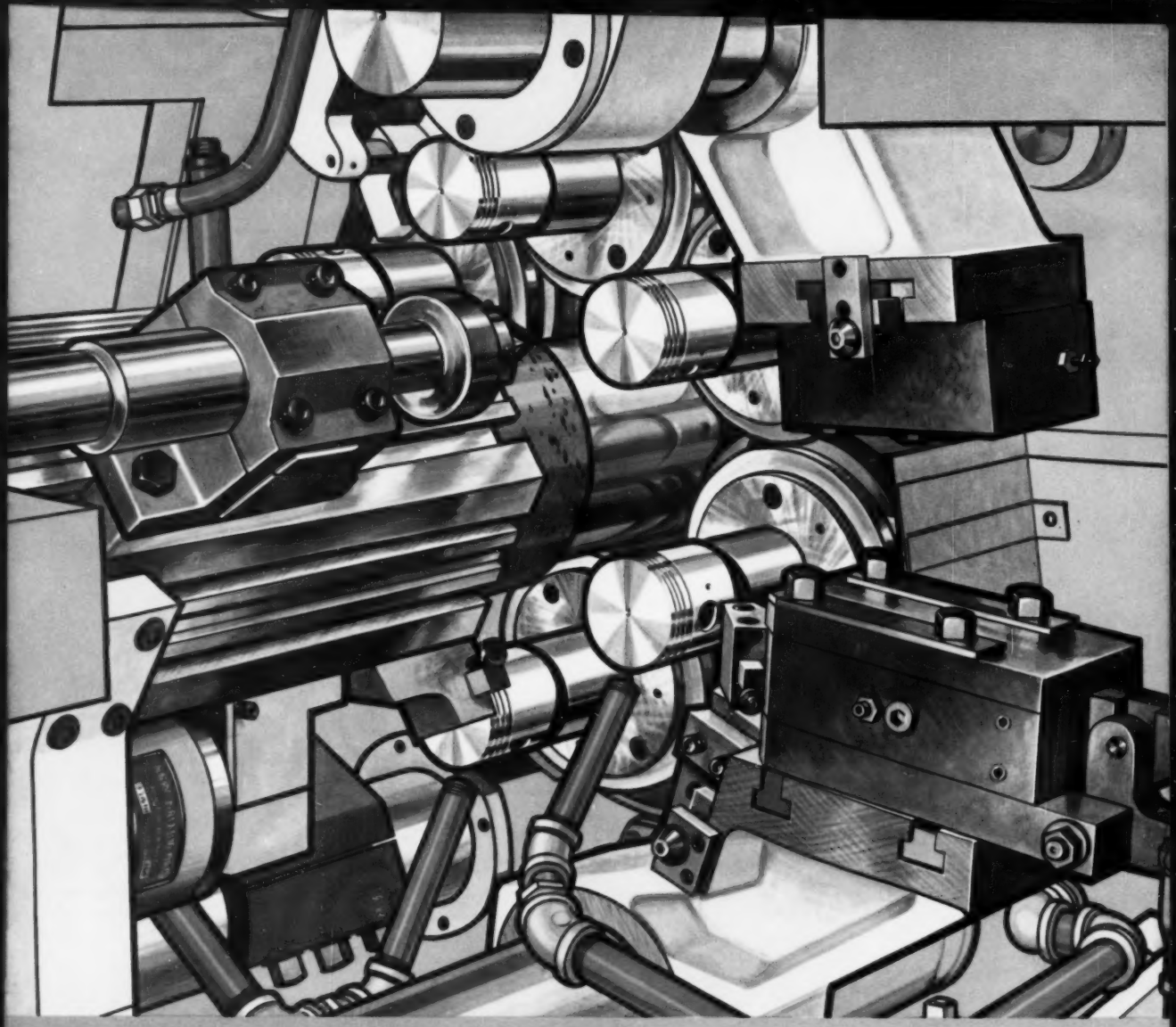


for lower costs — put more tools to work

You can make money with the speed, versatility, accuracy and extra operations possible on the *new* New Britain Automatic Bar Machines with independent radial cross slides in all six positions. More operations per machine, at higher speeds and feeds, mean more completed pieces in the pan, faster than ever before. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



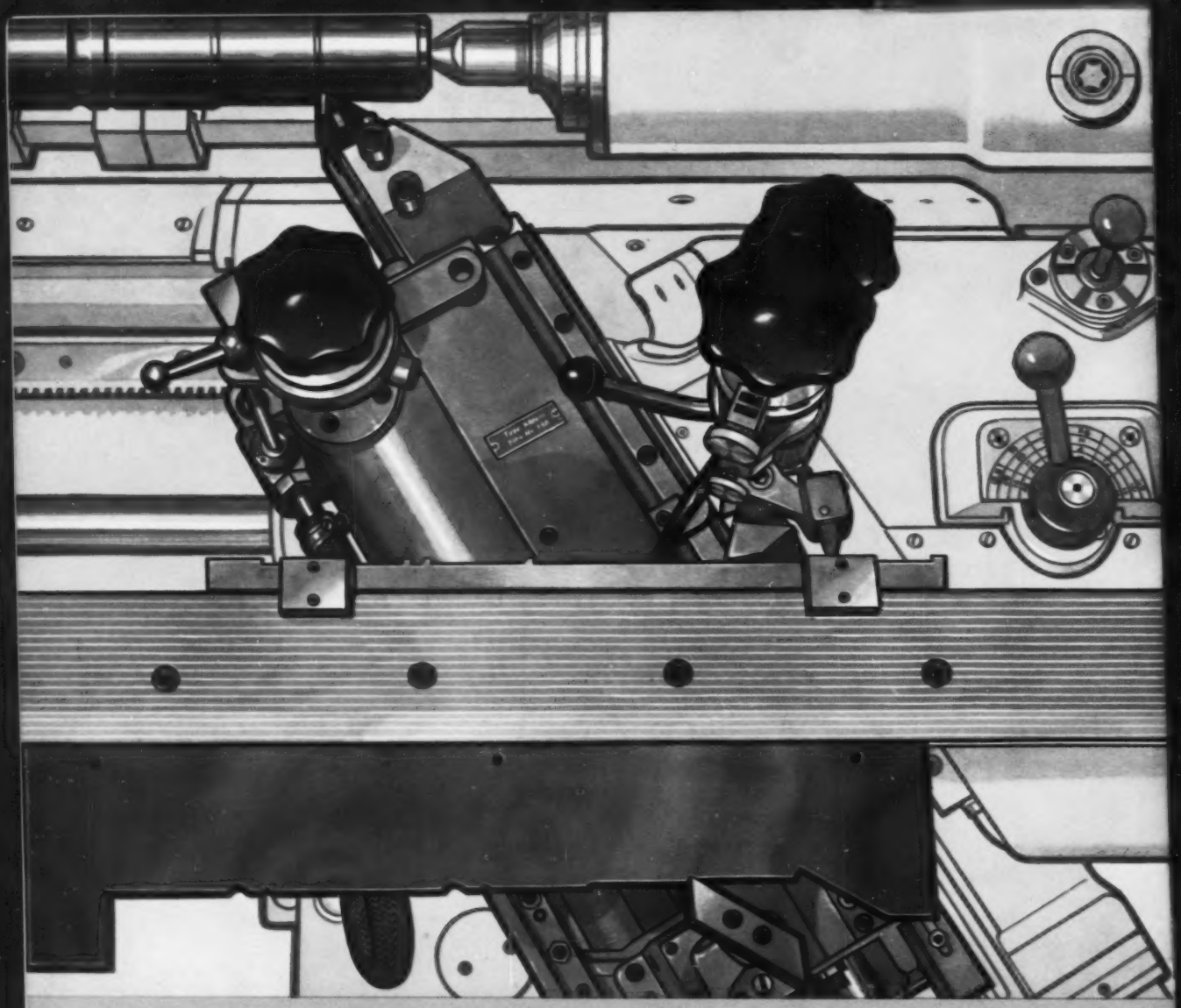
NEW BRITAIN AUTOMATIC BAR MACHINE



make higher production pay for itself

A New Britain four-, six- or eight-spindle chucker with open-end design, massive forming arms, large capacity (up to 15″) will machine your castings and forgings faster at less cost. You can measure it in *income* instead of *cost* because New Britain Chuckers pay as they go. New Britain's new financing plan makes large initial investment unnecessary. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

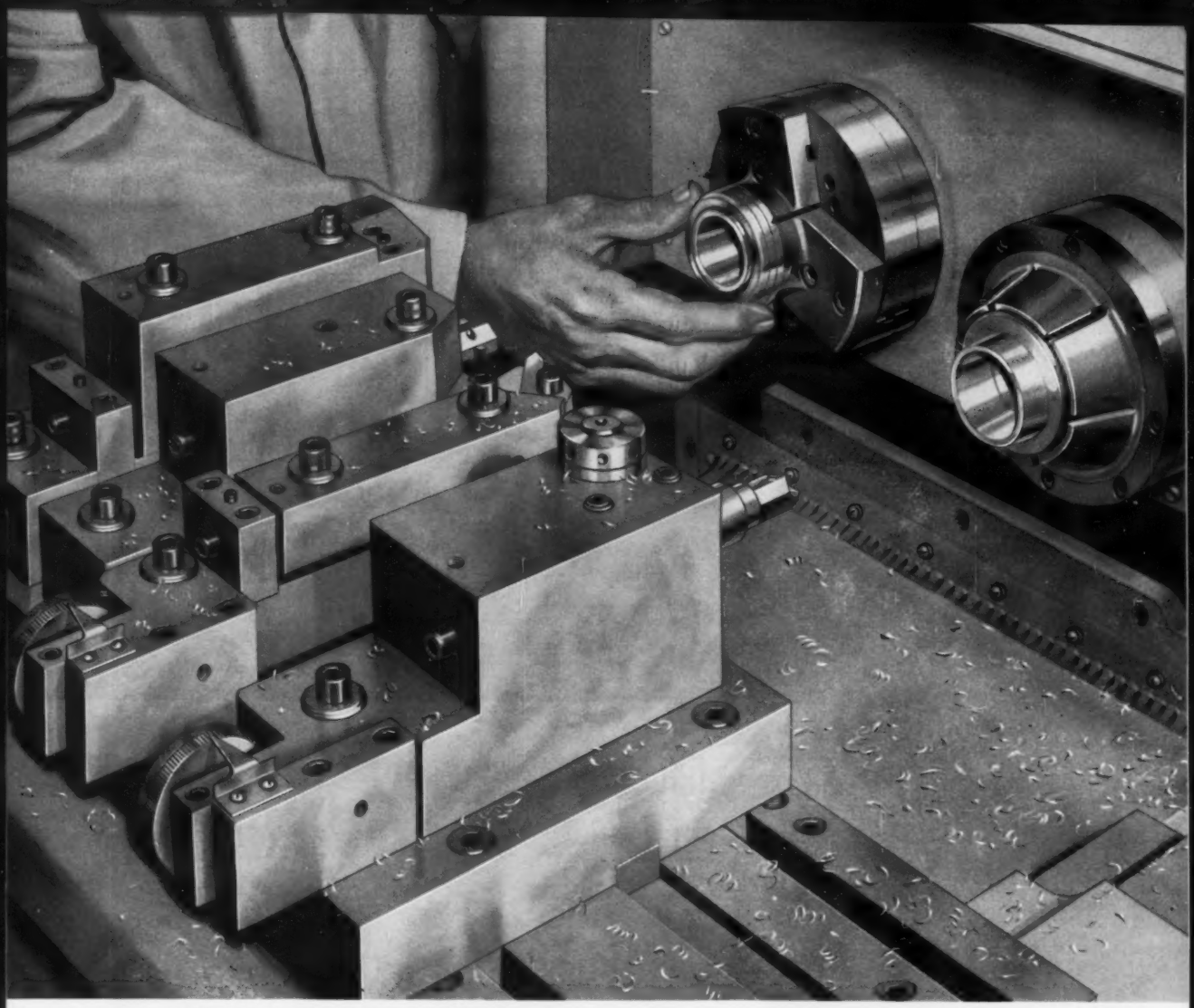
NEW BRITAIN CHUCKING MACHINE



you don't make money adjusting tools

With a New Britain +GF+ Copying Lathe you outproduce gang tool setups because you cut at maximum speeds and feeds for tool efficiency. No tool-wear worries! The single tool is changed in one minute. Every dimension is positively transmitted from template to work, making adjustment a simple matter of bringing one dimension to size — the others *have* to be right. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN +GF+ COPYING LATHE

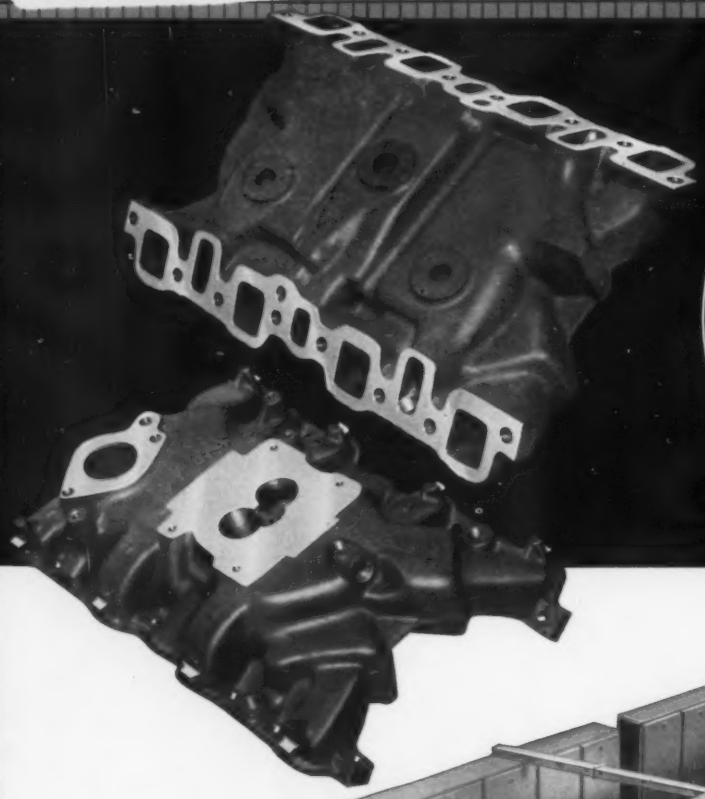


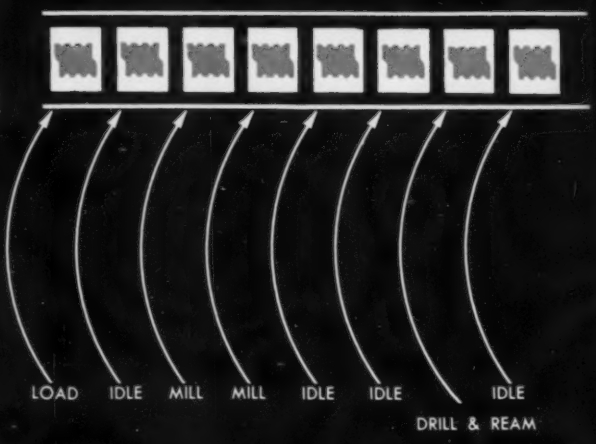
don't job it out — do it yourself

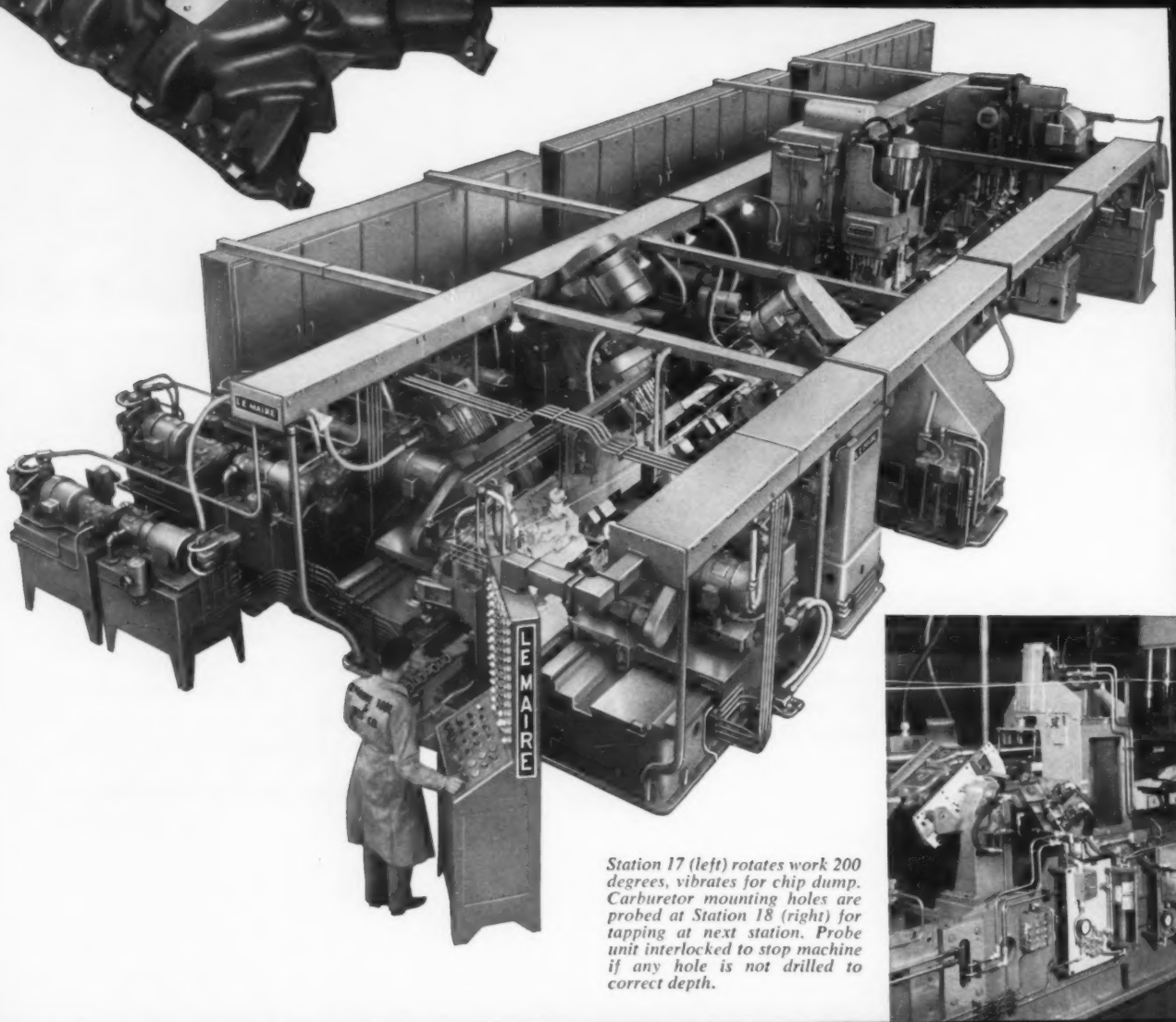
A New Britain Precision Boring Machine offers fast setups and single-point tooling for simplicity of operation; solidly mounted, cam-actuated contour slides for repetitive accuracy; high speeds and feeds for maximum production. Explore the many and varied cost-saving possibilities of this machine. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEW BRITAIN PRECISION BORING MACHINE

PRODUCING

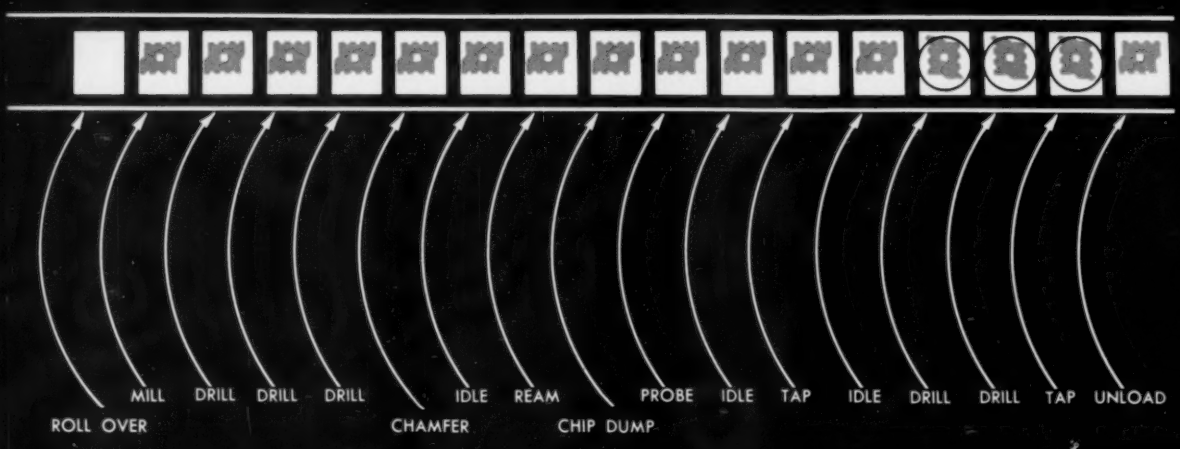






Station 17 (left) rotates work 200 degrees, vibrates for chip dump. Carburetor mounting holes are probed at Station 18 (right) for tapping at next station. Probe unit interlocked to stop machine if any hole is not drilled to correct depth.

with LE MAIRE



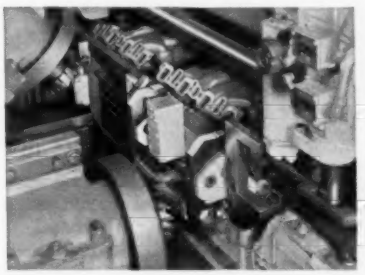
Truck Manifolds Completely Machined, Re-positioned 5 Times, in 55 Seconds

This 25-station LeMaire "Producer" completely machines three different styles of truck engine manifold castings. The machine is built for transfer-through operation and features automatic loading and clamping at each station. The part is re-positioned five times while in process during the 55-second machining cycle, including one 180 degree roll-over, one rotation for vibratory chip removal, indexing for a probing operation, one 90 degree index and re-index.

Features include: Unitized "building block" construction, with provision made for future changes—lighting at every work station—complete electrical interlock and individual selector switches and controls at each work station—"PresTest" lights on main control console—automatic selective lubrication of fixtures and ways—lights indicating "Automatic" or "Manual" control for safety during setups — electrical and hydraulic systems to J.I.C. — 189 hp electrical system—hardened and ground wear surfaces.

Here is another successful *producing* installation, designed, manufactured and tooled by LeMaire. Tell us about *your* next production machining problem.

Manifold mounting holes are drilled and one hole is reamed for precision location in following operations at Station 7.



Locating faces for subsequent operations milled on both sides of work at Station 3. Cutters at Station 4 mill both manifold faces, are retracted by cross slide after stroke to minimize wear.

Inserted blade cutter mills carburetor mounting pad at Station 10.

LE MAIRE MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD
DEARBORN, MICHIGAN

Designers and Builders of
Special High-Production Machines

Homko Thunderbird—Western Tool and Stamping Company's *all steel swept-line* power mower—mows without pushing. Engine drives blade and front wheel. Modern equipment like this demands modern protection. *All* Western power mower bearings are factory-lubricated with Texaco.

"Texaco helps keep our machining costs down, our output up"

says Plant Superintendent Lawrence Hancock, Western Tool and Stamping Co., Des Moines, Iowa.

"As the world's largest power mower producer, Western Tool and Stamping makes and sells 500,000 power mowers a year. There's no time for machine downtime. We get longer tool life, better finishes and fewer rejects with Texaco products," says Plant Superintendent Hancock.

Product	*Advantages*
Texaco Sultex Cutting Oil	assures longer tool life and better surface finish on hard-to-machine metals.
Texaco Soluble Oil	keeps grinding wheels and machining operations clean, remains stable in hard or soft water, allows dirt to settle out rapidly.
Texaco Regal Oil R&O	protects hydraulic circuits, prevents rust, sludge and foam.

Texaco Cutting, Grinding and Soluble Oils can improve your machining picture, too. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Visit Texaco at the Tool Show, Philadelphia, May 1-8 — Booth 2019

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

- Operation Bootstrap
- Up Expenditures?
- Down Taxes?
- Up Defense?
- Down Potomac Way

Keeping up with Washington

Loring F. Overman

WASHINGTON is more than ever a city divided. Current question: Is the present economic situation a recession, regression, or transition? The Administration holds, publicly at least, that the economy is reaching something of a transition plateau . . . that the second half of the year will witness an encouraging upturn. Critics hold that immediate action in the form of generous Government expenditures will be required to save the day.

With the Army's "Explorer" in orbit, pressure to forego politics and to launch a satellite "at all costs" is off, clearing the way for the kind of jockeying the country has learned to expect in an election year.

Up Expenditures?

Hint of what's in store followed the Administration's proposal for a $2,000,000,000 post-office construction and modernizing program to extend over a three to five year period. The program would be financed at the rate of $175,000,000 a year for direct Government modernizing expenditures; the $1,500,000,000 construction phase to be privately financed under lease-purchase contracts.

Shouting "too little, too late," some opposition spokesmen proposed an immediate upping of approximately $6,000,000,000 to be expended in fiscal 1959—starting next July 1. Increases proposed included an amount of up to $5,000,000,000 for defense and $1,275,000,000 for stepped-up public works.

Expanded public works—some of direct interest to machinery manufacturers—were proposed by Senator Dennis Chavez (D-N.M.). The Senator explained that only the release of additional funds would be required to place his concept of "operation bootstrap" in motion.

He suggested the following increases: highways $600,000,000; flood control and other water projects, $249,000,000; watershed program, $14,000,000; public buildings, $300,000,000; water pollution, $45,000,000; and reclamation, $70,000,000. Indications are that these are only the first of a long series of spend-for-prosperity proposals in which one party or the other will seek to improve either the national economy or the political outlook.

Down Taxes?

Another popular vote-wooing device, also freed when "Explorer" went into orbit, was the possibility of a cut in individual and corporate income taxes. Once considered impracticable, the tax-cut idea is winning new converts. Three indications are as follows:

Representative Robert W. Kean (R-N. J.) has prepared a stand-by tax reduction bill, ready for immediate consideration when, if, and as a tax cut is decided upon to relieve the economic situation.

Senator Paul Douglas (D-Ill.) has introduced two bills which would trim $3,000,000,000 from individual income taxes, and $1,400,000,000 from present excise schedules.

Representatives Sadlak (R-Conn.) and Herlong (D-Fla.) have introduced two more new bills which provide for a series of annual reductions in tax rates for both individuals and corporations. Top rate for each would eventually be reduced to 42 per cent.

Up Defense?

Typical of the differences of opinion which make Washington interesting are the following:

General Austin W. Betts, military aide to Department of Defense Guided Missile Director William M. Holaday, told an industrial editors' group that a vast and sudden input of money into the military program would create a danger to the economy. He urged instead a gradual build-up to head off the danger of inflation.

Senator Jackson (D-Wash.) has a different view. As a member of the Senate Armed Services Committee and chairman of the Joint Atomic Energy Military Applications Subcommittee, he says that an increase of $4,000,000,000 to $5,000,000,000 in the fiscal 1959 military budget of $39,100,000,000 is "the minimum increase needed to stay alive."

The Senator also proposes establishment of a National New Projects Laboratory under civilian direction. Among other functions, such a laboratory would provide scientists with one central place for exchanging ideas about critical problems.

Down Potomac Way

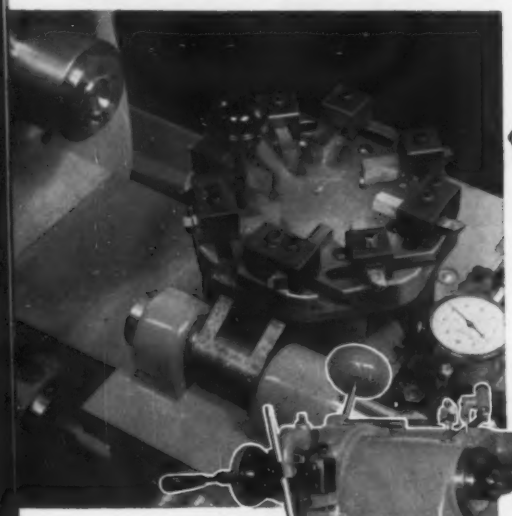
Depressed Areas are again coming in for special consideration in the placing of defense contracts. Defense Department, Office of Defense Mobilization, and Labor Department are studying proposals. Strength of the movement is indicated by the fact that forty members of the House have signed a petition urging the President to arrange immediate relief measures for depressed areas.

Russian Machinery came in for some compliments from Senator Ellender (D-La.) during a recent hearing on river development and related water resources. Commenting that the Russians are "inching ahead" in hydro-electric power development, the Senator added that in two large Siberian steel plants, he saw huge machinery unmatched by any he had observed in the United States.

Government-owned machine tools "have a direct effect on the machine tool industry," it is conceded in a quarterly report of the Attorney General, issued under Section 708 (e) of the Defense Production Act. The report is concerned with whether defense program operations tend to promote monopoly in the machine tool industry. The report conceded a slight trend toward greater concentration, but said this could not be attributed to the defense program.

HARDINGE
ELMIRA, N.Y.

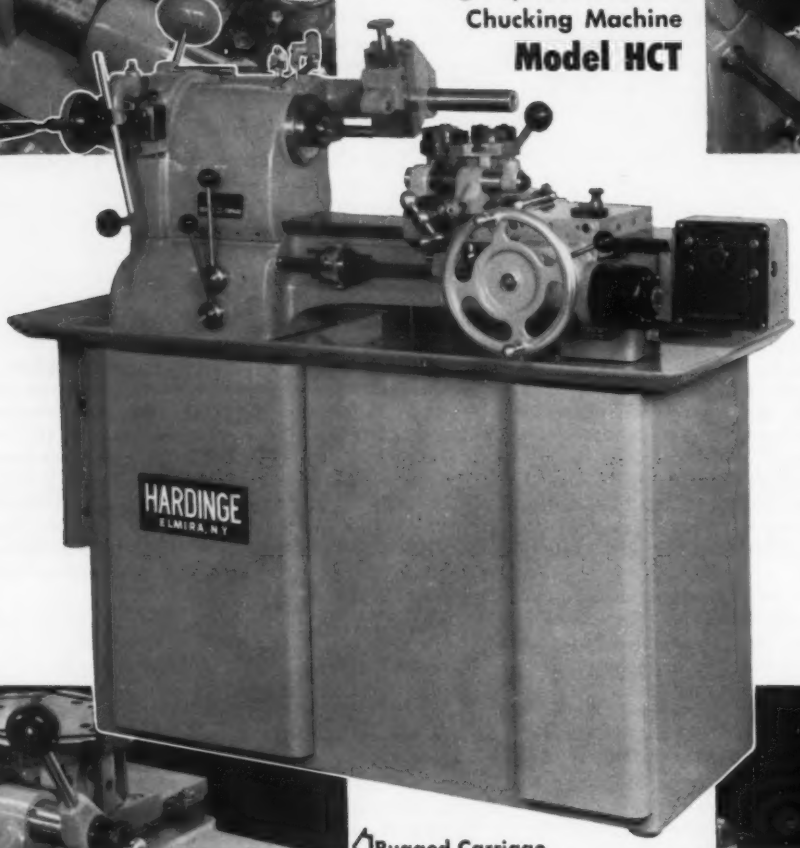
"Closer Tolerances Increase Demand for the HARDINGE HCT Precision Chucking Machine"



8-Station Turret

Flexible Range of Operation

High Speed Precision
Chucking Machine
Model HCT



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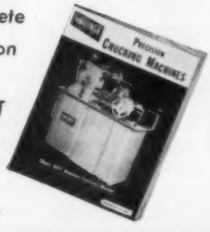
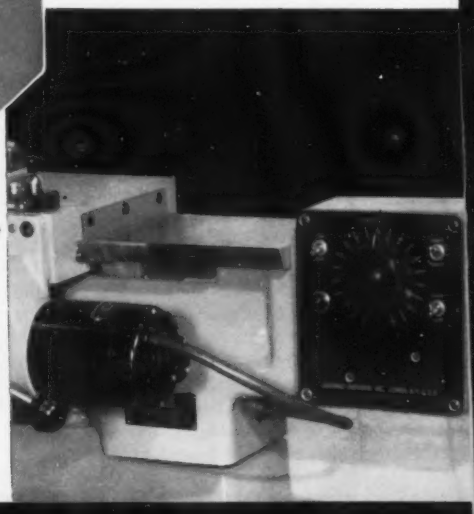
Hardinge Model HCT Precision Chucking Machine finishes diameters, recesses, shoulders, back faces, front faces, and cuts precision threads in *one setting – all concentric* with each other. Tooled inexpensively with standard tool bits.

Rugged Carriage

Independent Variable
Carriage Feed

For complete information write for Bulletin HCT





HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Machinery
APRIL 1958

Higher Wages— for Greater Production

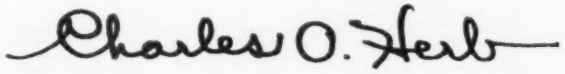
INDICATIONS seem to point toward an upset this spring in the tranquil relations that have generally prevailed between labor and management over the last several years. Sage counsels of some union leaders to forego demands for higher wages at this time and the plea of President Eisenhower that wages and prices be held as close as possible to present levels are apparently to be ignored. Instead, at least one proposal has been made that is considered unacceptable by the companies involved. There must be some sound basis for avoiding serious difficulties at this time!

One of the sanest suggestions ever made for eliminating strife between labor and management has been advanced by Harold J. Ruttenberg, who at one time was research director and economist for the United Steel Workers and today is the head of a company that annually produces $7,000,000 worth of well-drilling equipment. Mr. Ruttenberg proposes that higher wages be paid for greater production.

Obviously, unless production is increased, wage raises are necessarily reflected in higher prices, a continued inflation spiral, and a reduced market for the product until all other workers have had a proportionate increase in pay. When that occurs, the union members who had the original pay increase lose their advantage, and they attempt to start the cycle all over again. If higher wages are based on greater productivity, prices need not be increased.

Mr. Ruttenberg further suggests that if labor unions would agree to such a proposal, leaders of industry should pledge themselves to provide the maximum capital that their resources would permit for the purchase of equipment that would boost productivity. Also, the best management should be set up for the development of "equipment, materials, and human physical and mental efforts to increase production."

Other important details are suggested in the Ruttenberg proposal, such as more and improved trade training schools, but the gist of the program is the payment of higher wages for greater productivity, made possible by the use of modern machinery. Here is, at last, a sound basis for the elimination of labor and management difficulties proposed by a man schooled to analyze the problem from both sides of the fence.



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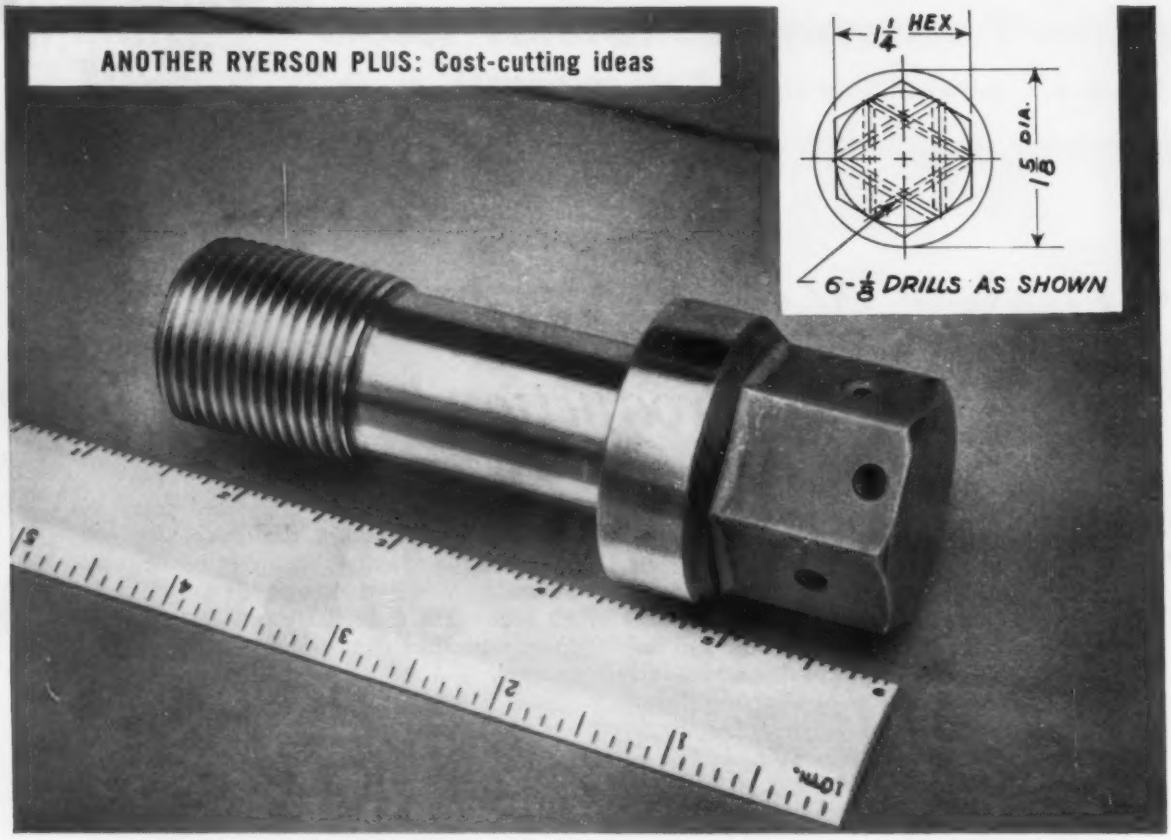

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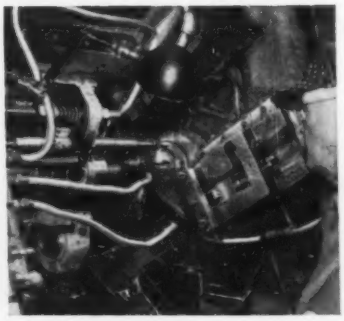
Rycut 40 alloy steel boosts production 30%, tool life 50%

Drilling piston pin bolt heads of AISI 4140 was a costly problem at Hyland Machine Co., Dayton, Ohio.

The job called for cross-drilling two holes in each face of the hex head (see diagram). A Ryerson specialist recommended new Rycut 40, the world's fastest machining alloy steel in its carbon range.

Here are the results, from Partner Forest Hyland: "We have cut down drill breakage. We have 15% fewer rejections. There is a marked improvement in finish, plus a comparable saving shown in milling the head of the bolt. Tool life on the automatic screw machines is 50% longer, total production is up 30%. Now we can produce this bolt at a competitive price."

There is a dependable, cost-cutting steel at Ryerson to meet every requirement. The Ryerson quality controls assure you of getting steel you can count on for dependable performance—every time. Ask your Ryerson specialist for help on your steel problems.



Six-spindle automatic screw machine producing piston pin bolts with cost-cutting Rycut 40.

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ROTARY EXTRUSION

Reduces Costs and Saves Material

Substantial material savings and cost reductions are being realized by the Aircraft Engine Division of Ford Motor Co. in producing various jet-engine components by the cold power spinning, or power roll-forming, method.

J. GENIS, Supervisor, Semi-Production Engineering
and
W. MALLINDINE, Production Process Engineer
Aircraft Engine Division
Ford Motor Co.
Chicago, Ill.

"ROTARY EXTRUSION" is the term adopted by the Aircraft Engine Division of Ford Motor Co. to identify the process of power roll-forming material to the shape of a rotating mandrel. With this chipless machining method, sometimes referred to as cold power spinning, metal is plastically deformed and progressively displaced under the heavy compressive stress of a pressure roller as the roller traverses a path parallel to the side of the mandrel. Hollow parts with circular cross-section and straight sides—such as cones and cylinders—can be produced in this way from blanks, drawn cups, welded cylinders, forgings, or castings. Also, when the machine is equipped with a contour-tracing attachment,

curvilinear wall sections and tubes having multiple diameters can be formed.

Rotary extrusion is considerably different from conventional spinning. In conventional spinning, the diameter of the blank must be larger than that of the finished part, and hand tools are used to fold the metal over a mandrel under moderate pressures. Reduction in the thickness of the metal is only slight, and since any reduction cannot be accurately predetermined, finished parts are not always uniform and close tolerances cannot be maintained.

In contrast to this, very large reductions in material thicknesses can be accomplished with rotary extrusion. The metal undergoes a shear deformation, under pressures up to 50,000 psi, and the diameter of the finished part is equal to that of the blank. As illustrated in Fig. 1, a rectangular cross-sectional segment X in the blank becomes a parallelogram shape X_1 in the finished part, and the blank thickness T is reduced to T_1 in the finished part.

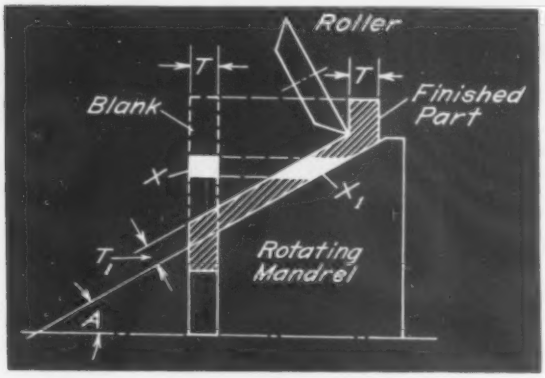

Fig. 1. In rotary extrusion, the diameter of the finished part is the same as that of the blank, and the original thickness (T) is reduced to (T_1).

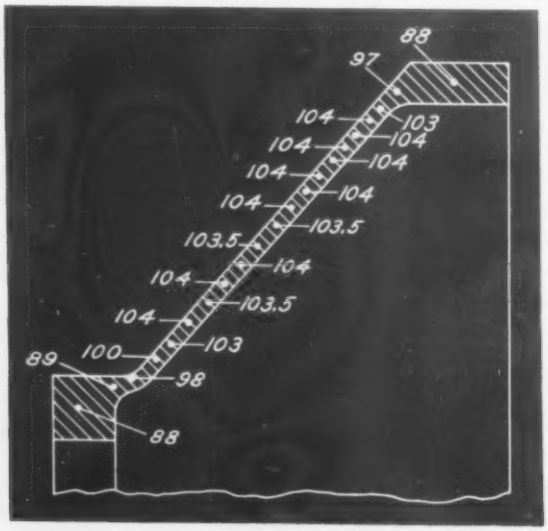

Fig. 2. Hardness readings (Rockwell B scale) obtained on sectioned part made from AMS 6322 steel show increase in hardness resulting from the rotary extrusion process.

Metal thickness can be reduced 75 per cent or more in one pass to a minimum included angle of 30 degrees, depending on the characteristics of the material being extruded. In this type of shear-spinning, the reduction in thickness follows the sine law—the wall thickness T_1 of the finished part is equal to the thickness T of the flat blank times the sine of one-half the included cone angle of the work-piece A. Expressed as a formula:

$$T_1 = T \sin A$$

By using preformed blanks, cones of varying wall thickness can be produced.

Cold-working during rotary extrusion results in substantial increases in the tensile strength and fatigue resistance of the metal. Also, the hardness of the material is increased, as illustrated in Fig. 2. This is a cross-sectional drawing of a jet-engine part that was rotary-extruded from a pierced and annealed plate of AMS 6322 alloy steel. The values given at various locations along the part are hardness readings obtained on the Rockwell B scale. Despite the high forming pressures employed, microstructure analyses of stressed parts have shown no evidence of fractures developing in the crystalline structure.

Regardless of the material being power roll-formed, the dimensions of the finished part depend on the accuracy of the mandrel and how closely the pressure roll follows the mandrel. Wall thicknesses and inside diameters can easily be held within plus or minus 0.002 inch. The surface finish produced on roll-extruded parts depends on the material being formed, the rate of feed, and the roller design. Incorrectly shaped rollers may undercut the blank, causing a burr and producing a rough surface. While feed rates ranging from 0.005 to 0.100 inch per revolution have been used, best results are obtained with feeds from 0.010 to 0.050 inch per revolution. The speeds employed range from 1500 to 2250 surface feet per minute.

Rotary extrusion is performed on Floturn lathes made by the Lodge & Shipley Co., and Hydrospin machines made by the Cincinnati Milling Machine Co. In using the Floturn lathe, Fig. 3, the blank is hydraulically clamped between the ram on the motor-driven screw-operated tailstock and the formed mandrel which is mounted on the headstock. The mandrel and work are rotated by the headstock spindle, which is pow-

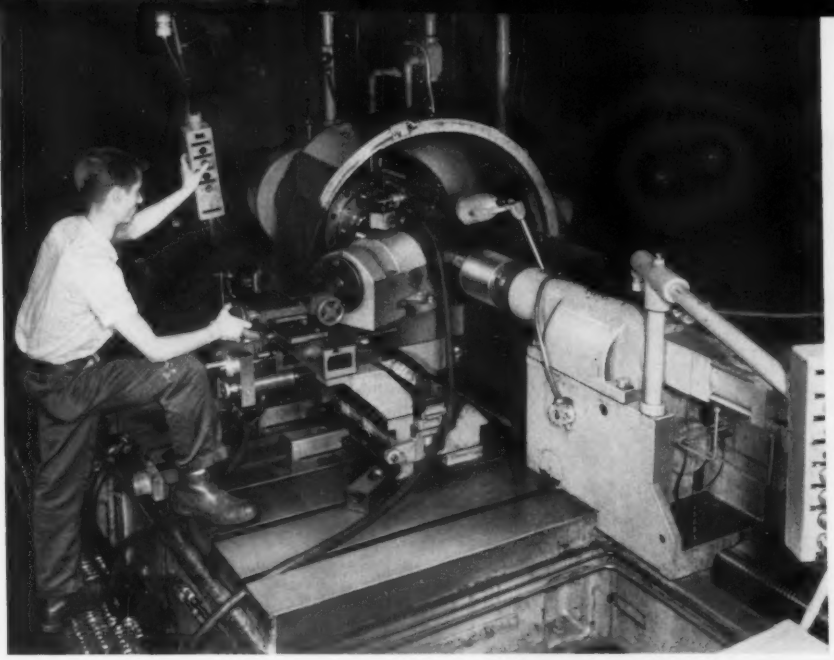

Fig. 3. Floturn lathe equipped with tracing unit to permit contour-spinning. Blank is hydraulically clamped between tailstock and mandrel.

ered by a direct-current motor and variable-speed drive unit that provides infinitely variable spindle speeds from 33 to 1000 rpm. Blanks up to 42 inches in diameter can be handled, and parts up to 50 inches long produced on the Floturn lathe.

A hardened and ground roller, 10 to 12 inches in diameter and mounted on Timken roller bearings, is power-fed parallel to the periphery of the mandrel to flow the metal to the precise shape of the mandrel. The independent forming-roll carriage can be pivoted on its bed so that the roll can be fed parallel to mandrels having various included angles up to 100 degrees. Rotation of the roller is achieved by friction as it contacts the work. Pick-off gears on the forming-roll cross-slide are used to vary the feed rate from 1/4 to 9 inches per minute. The large handwheel on the carriage is for moving the roller toward or away from the work. Automatic stops limit the travel of the roller.

Typical of the many jet-engine parts being produced on a Floturn lathe is the intermediate bearing support, shown on the machine in Fig. 4,

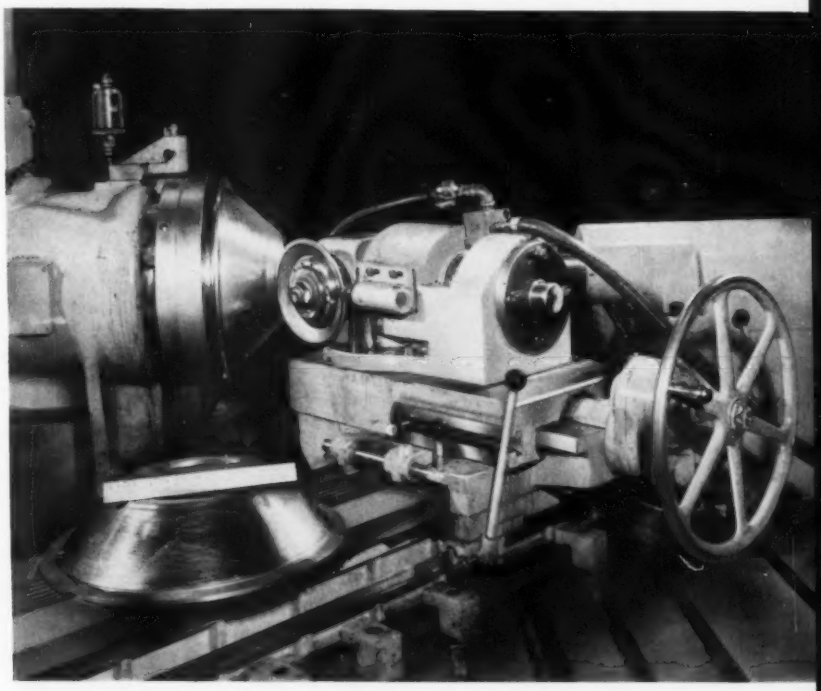

Fig. 4. Intermediate bearing supports, power roll-formed from AMS 6322 alloy-steel forgings on this Floturn lathe, provide a saving of $18.

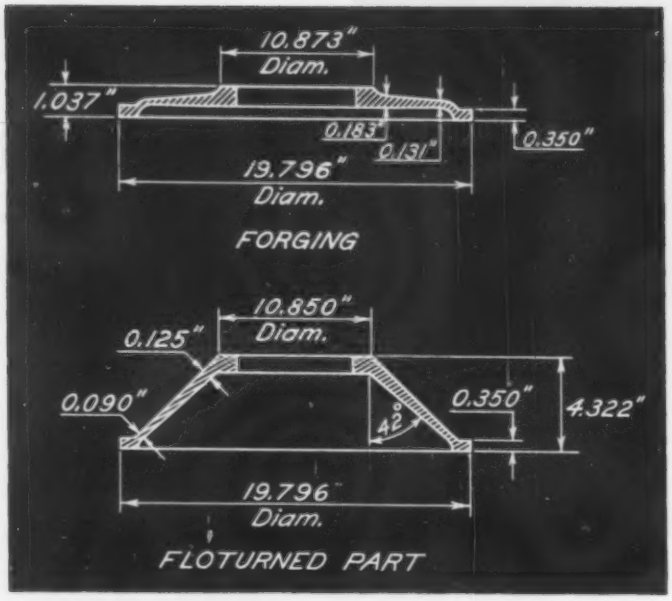

Fig. 5. Dimensions of forging (top) and completed intermediate bearing support (bottom). Previously, the part was machined from shaped forging.

made from AMS 6322 alloy steel. This part was formerly forged to the required height and included angle, and then machined. Now the support is made by the rotary extrusion process from a simple, flat forging, illustrated at the top in Fig. 5. This change-over has resulted in a savings of approximately $18 per forging, and a further cost reduction of about three man-hours per part.

Another interesting application of rotary extrusion is in the production of bullet-nosed, combustion-chamber liners, approximately 5 5/8 inches long by 2 3/4 inches in diameter, made from Inconel. The liner was formerly fabricated in two sections that were joined together by fusion welding. Now the parts are blanked and preformed from 0.076-inch thick sheet stock, as seen at the left in Fig. 6, prior to Floturning, Fig. 7. This change in processing has eliminated ten operations, and has resulted in a savings of 40 per cent in production hours.

Engineers in the Semi-Production Department at Ford's Aircraft Engine Division designed and built a special mechanical tracing unit for this operation. The unit is powered by the longitudinal feed lead-screw of the Floturn lathe, and a solid cam is used to provide the contour cycle. While contour-spinning (involving the cross-slide tracer control) is used in forming the rounded nose portion of the combustion-chamber

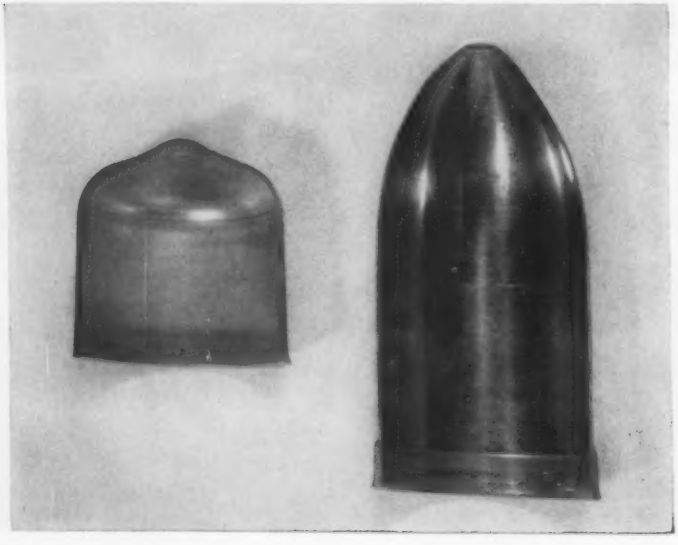

Fig. 6. Combustion-chamber liners were formerly made in two sections and welded together. Now parts are rotary extruded after blanking and preforming.

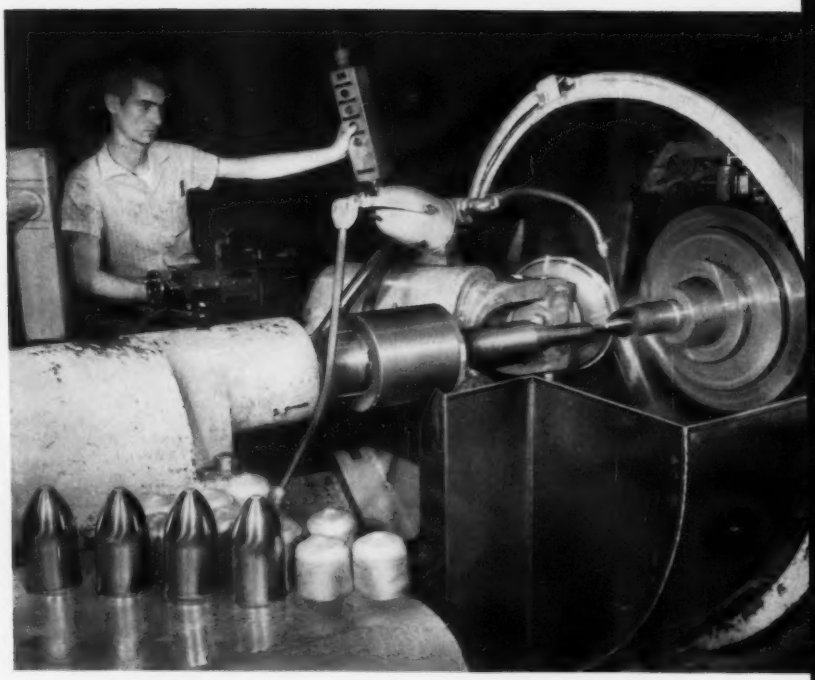

Fig. 7. Floturning setup for producing Inconel combustion-chamber liners. This method resulted in a saving of 40 per cent in hours.

liner, the roll- or tube-spinning technique is employed for the straight portion of the liner body.

Tube-spinning is essentially a process of continuous point extrusion, with the amount of reduction in material thickness possible depending on the pressure capacity of the machine and the ductility of the material being formed. Reductions as high as 88 per cent have been made on AISI 4130 steel without the need for annealing the work-pieces between passes.

Rotary extrusion of the Inconel combustion-chamber liners is performed with the work rotating at 850 rpm and the forming roller fed at the rate of 4 1/2 inches per minute. The flat-sided roller has a full semicircular periphery with a radius of 0.250 inch.

With the Cincinnati Hydrospin machine, the desired shape of work-piece is spirally generated by two opposed forming rollers, as seen in Fig. 8. The roller slides can be set parallel to each other for tube-spinning parts up to 42 inches in diameter, or at one-half the included angle to shear-spin conical parts of any included angle. Also, if the design of the part permits, the front slide may be set to do one forming operation on the

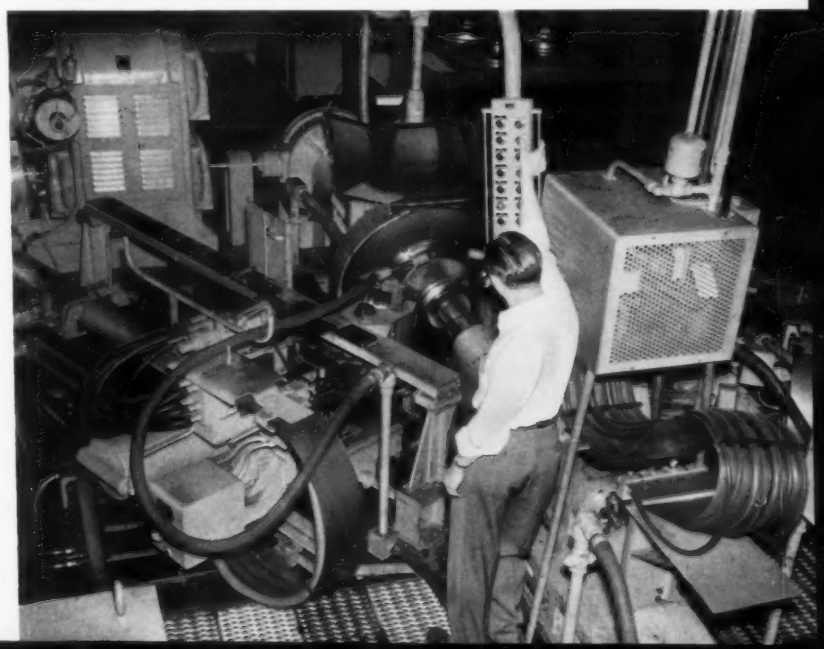

Fig. 8. Two opposed forming rollers and a hydraulic contour-tracing attachment are employed to spirally generate various shaped parts on Hydrospin machine.

part, while the rear slide can be set to perform a subsequent operation on the same part. The main slides of the machine are universal, so that parts can be rotary-extruded with their formed surfaces parallel to, perpendicular to, or at any angle to the center lines of the headstock and tailstock.

The Hydrospin machine is equipped with a hydraulic contour-tracing attachment which can be mounted on either cross-slide. End-mounted rollers are available for internal upsetting and flanging operations. Spindle speeds are infinitely variable from 116 to 465 rpm, and the feed rates (also infinitely variable) range from 0 to 35 inches per minute on the cross-slide, and from 0 to 52 inches per minute longitudinally on the saddle. Maximum swing of the work-piece can be 42 inches. A Flamatic attachment, Fig. 9, has been provided for flame heating of titanium parts during forming. Oxy-acetylene torches having 30 flame tips are used to preheat the titanium blanks and maintain them at a temperature of 1000 degrees F. during rotary extrusion. The temperature is controlled by a Ray-O-Tube indicator. Oxygen, under a pressure of 50 psi, is mixed with city gas (15 psi) in the ratio of 1.7 to 1. The

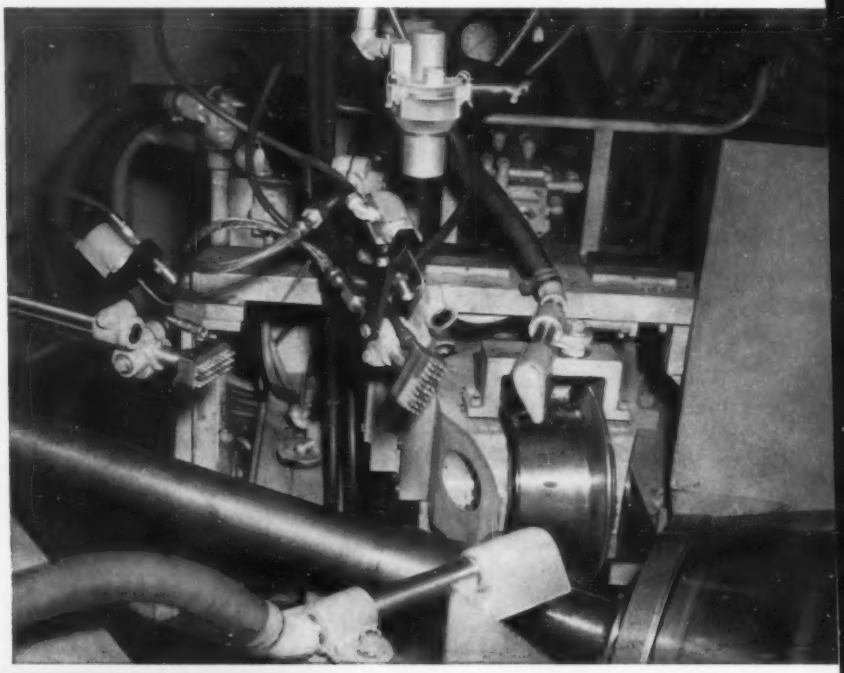

Fig. 9. (Right) In Hydrospinning titanium parts, oxy-acetylene torches are used to preheat the blanks and maintain them at a temperature of 1000 degrees F. during forming.

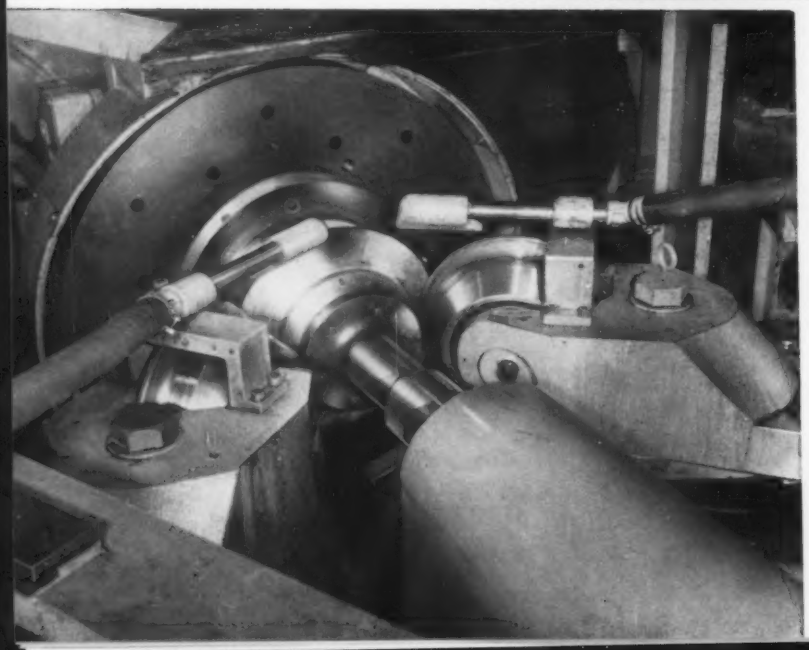

Fig. 10. (Left) Rotary extrusion of a rear bearing support for a jet-engine compressor from a premachined, AMS 5613 stainless-steel forging.

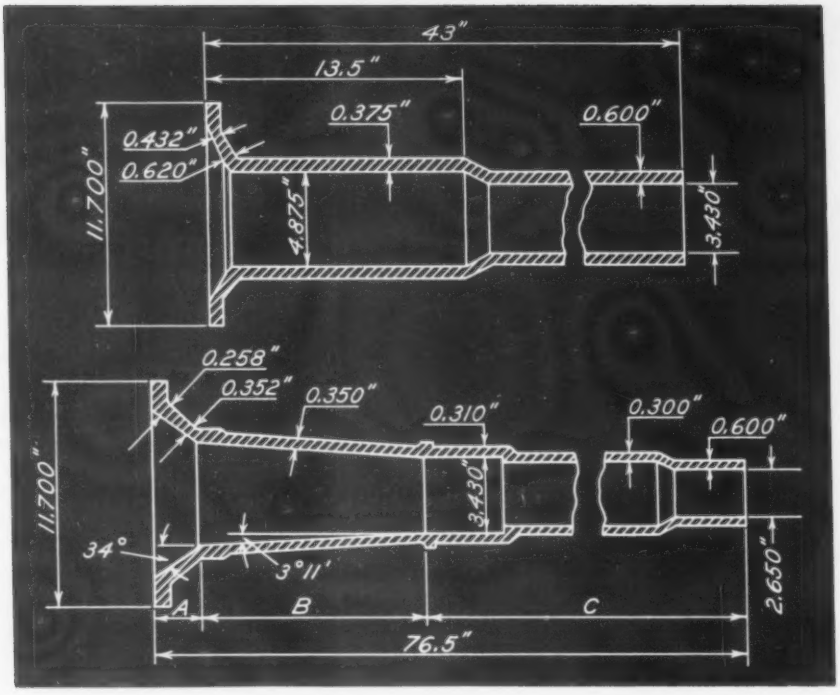

Fig. 11. Jet-engine turbine drive-shaft, seen at the bottom, is power roll-formed from 43-inch long, upset and pierced forging of AMS 6415 alloy steel shown at top.

consumption of oxygen is about 12 cubic feet per hour, and of gas, 7 cubic feet per hour.

Hydrospinning of a rear bearing support for a jet-engine compressor is illustrated in Fig. 10. These supports are made from AMS 5613 stainless-steel forgings that are premachined prior to power roll-forming. During rotary extrusion, the thickness of the wall is decreased from 0.234 to 0.110 inch, and the diameter of the part remains at 14.975 inches.

Johnson's Wax - Draw, a non - drying, nonhardening drawing compound, is brushed on both sides of the machined forging prior to roll-forming, and a soluble-oil coolant is flowed on the work during the operation. The work-piece is rotated at 400 rpm, and the rollers are fed at the rate of 2 inches per minute, with the main slides set at an angle of 28 degrees and the cross-slide, at 10 degrees.

Very favorable results have been obtained in the experimental Hydrospinning of long drive-shafts for jet-engine turbines. Starting with a 43-inch long, upset pierced forging of AMS 6415 alloy steel (seen at the top in Fig. 11), the shaft is rotary extruded to an over-all length of 76.5 inches (as shown at the bottom). Shafts thus produced require no further machining of their bores other than a short splined section, thereby eliminating the need for special contour-boring lathes and considerable machining time. Eventually, it is hoped to limit the machining required on the outer periphery of the extrusion to critical surfaces only.

Of interest in this particular application is the fact that three different types of rotary extrusion are employed. In power roll-forming portion *A* (the large diameter, 34-degree angle, flanged end of the shaft), metal is displaced by shear-spinning in accordance with the normal sine-law theory previously described. Portion *B* (the conical-shaped, 3-degree 11-minute angle section of the shaft), however, must be "downhill" flowed due to the small angle required. In effect, this is a complete reversal of the sine-law theory. The tubular, parallel side portion *C* of the shaft is formed by tube-spinning—which is simply a method of increasing the length by reducing the wall thickness.

Mandrels for rotary extrusion are made from a chromium-molybdenum alloy steel, AISI 4140, and surface-hardened to between 56 and 59 Rockwell C prior to grinding. Rollers, or tool rings, are made from Graph-Mo tool steel, made by the Timken Roller Bearing Co., and hardened to between 63 and 65 Rockwell C.

The geometry of the rollers is an important factor in obtaining good results with rotary extrusion. In general, a good starting point for shear-spinning is to provide a radius on the roller equal to the thickness of the material to be displaced. For tube-spinning, the radius should be about twice the material thickness.

Tests Show Superiority of

MAN-MADE INDUSTRIAL DIAMONDS

for Grinding Wheels

Here for the first time are the results of a comprehensive test program conducted to determine the relative efficiency of grinding wheels made from natural and man-made industrial diamonds. In grinding carbides, man-made diamonds performed on an average of 35 per cent better.

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NORMAN LEVENTHAL, Development Engineer
Metallurgical Products Department
General Electric Co., Detroit, Mich.

THE DISCOVERY of a reproducible process for making industrial diamonds was announced in February, 1955, by the Research Laboratory of the General Electric Co. The responsibility for developing a commercial process to produce the man-made diamonds was assigned to the Metallurgical Products Department of the General Electric Co., Detroit, Mich. When it was shown that the inherent process capabilities were such that the product could be competitive, costwise, with natural diamonds, one question remained unanswered: "How well do they cut?"

To answer this question, a comprehensive program was launched to determine the relative grinding efficiency of natural and man-made diamonds. A series of laboratory and production-machine applications were chosen to obtain comparisons in a wide range of common tungsten-

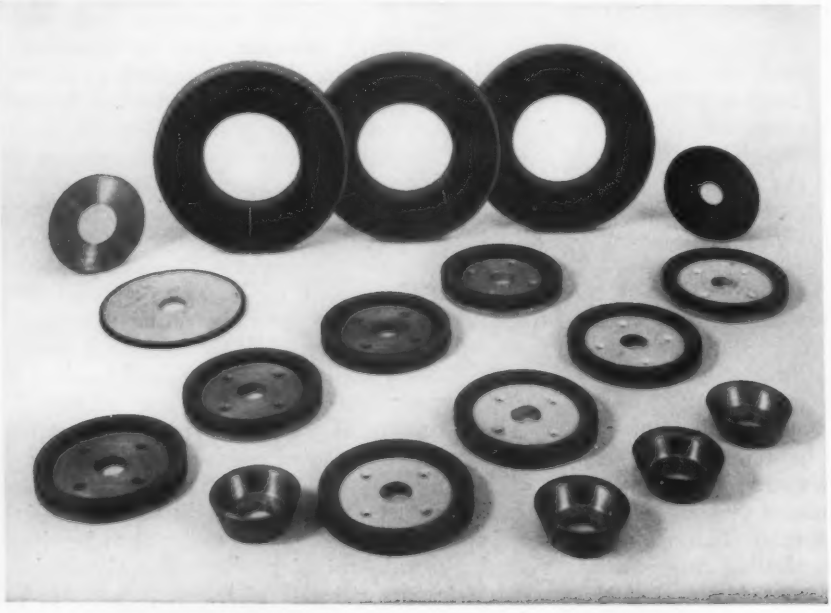


Fig. 1. Assortment of straight, plain-cup, and flaring-cup grinding wheels made from man-made diamonds for use in comparison tests. Straight wheels in the center background are 5, 7, and 10 inches in diameter.

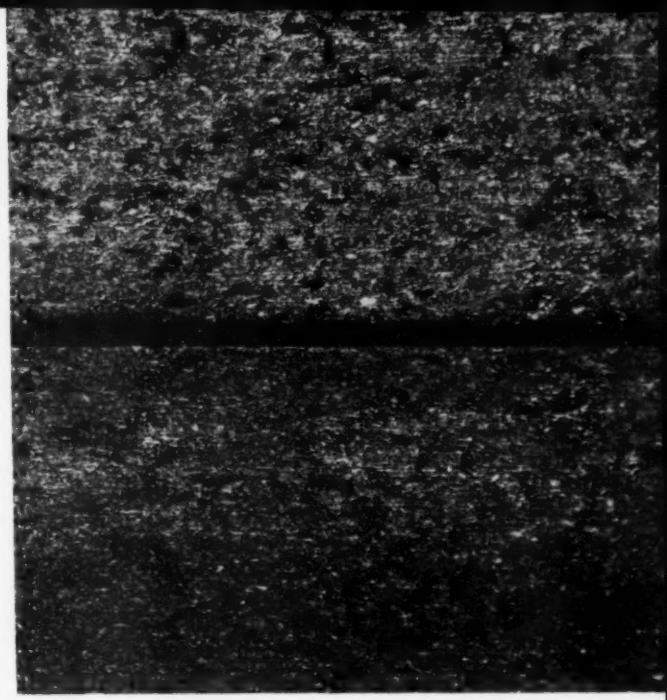


Fig. 2. Views of worn diamond grinding-wheel surfaces of identical specifications. Natural-diamond wheel at top shows more pockets than man-made diamond wheel at bottom. Man-made crystals hold better in the bond.

carbide grinding applications. Some of these involved fixed-feed surface grinding, tool and cutter grinding, and single-point tool grinding. The results were surprising—man-made diamonds were found to be superior to natural diamonds in resin- and vitreous-bonded diamond wheels for the grinding of cemented tungsten carbide. This superiority averaged 35 per cent, with some production-grinding tests showing results as high as 100 per cent better than wheels made with natural diamonds.

Preparation of Test Wheels

Being aware of the number of variables involved in making up test wheels—such as bond batch, pressing temperatures, and cure cycle and temperatures—it was important that all controllable factors be kept constant. The only variable would be the diamond type. In all cases, the comparison tests involved every effort to minimize variables other than the diamonds themselves.

Companion wheels were made up by the grinding wheel manufacturers using closely sized natural and man-made diamonds on production equipment. The companion wheels were made from the same resin or vitreous type bond batch and processed through curing cycles at the same time. Wheel manufacturers applied the normal sizing technique to both types of diamonds, so that the average particle size and distribution were the same for each comparison set of wheels. In all tests reported, results have been limited to applications where quantitative comparison data was obtainable, and results are reported as the ratio of cubic inches of carbide ground per cubic inch of wheel wear. A group of various sizes and shapes of wheels made from man-made diamonds and employed in the different comparison tests are shown in Fig. 1.

Method of Laboratory Testing

The first step in wheel performance tests involved testing in the laboratory of the Metallurgical Products Department's Diamond Section. Operations were performed on a Brown & Sharpe No. 2 surface grinder, with a spindle speed of 5000 rpm, a table traverse of 372 inches per minute, and a cross-feed of 0.050 inch per table pass in both directions. Total vertical down feed per run was 0.200 inch and the vertical feed for each completed cross-feed in both directions was 0.001 inch. The carbide work surface ground was 2 inches wide by 12 inches long, made from Carboloy cemented carbide Grade 883 (a tungsten carbide with 6 per cent cobalt binder). Grinding was performed wet with soluble oil and water in a ratio of 1 to 400.

The wheels were mounted on precision, tapered-hole collets to run true radially within 0.001 inch, and laterally within 0.002 inch. A Norton brake-controlled truing device was used for the setup. The results recorded included wheel wear obtained by averaging micrometer readings to the nearest 0.0001 inch on three marked diameters. Material removed was also measured to the nearest 0.0001 inch. Power measurements and Profilometer readings were compared in all cases.

Laboratory results indicated that the performance of the wheels made with man-made diamonds was superior, in varying degrees, in terms of the ratio of cubic inches of carbide removed per cubic inch of wheel wear. With equal down feeds on the surface grinder, the wheels containing man-made diamonds removed an average of 2 per cent more carbide, and the wheel wear was significantly lower.

Prior to being put out in the field, most of the wheels were pre-tested in the laboratory to obtain a preliminary evaluation. In these tests, power requirements were compared on a recording wattmeter. The man-made diamond wheels required from 20 to 35 per cent less power during the actual grinding of the carbide. This indicates that the wheels are freer cutting, and have less tendency to load up with metal.

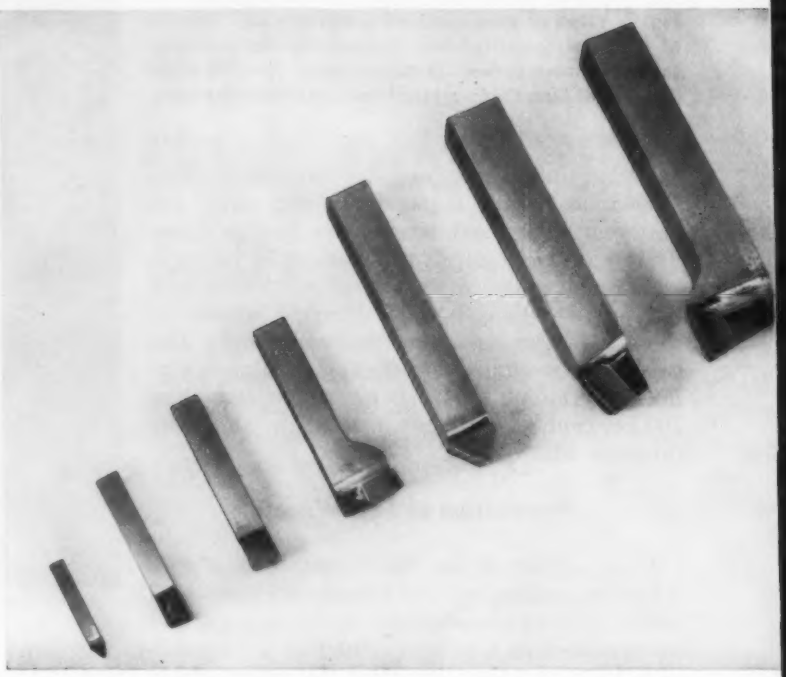


Fig. 3. (Right) Typical group of Carboloy cemented-carbide tools which were ground in comparison tests to determine the relative efficiency of man-made diamond and natural-diamond grinding wheels.

Fig. 4. (Below) Automatic two-station tool-grinder employed in testing diamond wheels. A wheel with natural diamonds was used at one station, and one with man-made diamonds at the other station.

In most cases, the finish produced on the carbide with man-made diamond wheels (as determined by a Profilometer) was equal, and in a few cases superior, to that obtained with natural-diamond wheels. Examination of the wheel surfaces under the low-power microscope showed noticeably more empty diamond sockets in the faces of the natural-diamond wheels after grinding. A typical example of this phenomenon is shown in Fig. 2.

Evaluation of Wheels on Production Grinders

After the laboratory tests, wheels were made up for evaluation on production grinding machines. In all cases, the operator was unaware which wheel contained man-made diamonds. Wherever possible, the types of carbide ground, as well as the sizes of the work surfaces, were kept the same for each set of companion wheels, to avoid factors that might influence final results.

The location for one phase of the testing was in General Electric Co.'s Metallurgical Products Plant in Edmore, Mich., where thousands of single-point tools are ground daily on a single shift. Some of the carbide tools ground in various tests are seen in Fig. 3. In these tests, the wheels—one with natural diamonds and the other with man-made diamonds—were placed on two automatic, two-station tool-grinders, side by side. These tool-grinding machines, one of which is shown in Fig. 4, were developed during World War II by the Hotpoint Co., Chicago, Ill.

Tool orders of a specific type were split so that the same number of tools of a certain size and specification were ground on each wheel. In an effort to reduce operator and machine effect on the test results, the wheels were transferred back and forth between the grinding machines every other day. Detailed results of carbide loss and

wheel wear were accumulated until the wheels were completely used.

Wheels chosen for the production tests on the Hotpoint grinders were standard—vitrified-bond, plain-cup wheels, 6 inches in diameter by 3/4 inch thick and with a 1/2-inch rim. Such a wheel is shown in Fig. 5. The specifications called for 120-grit diamonds of 100 concentration, with a 1/8-inch diamond depth on the wheel face. In a typical test, one of these wheels containing man-made diamonds removed 45 per cent more carbide. Also, this wheel ground 19,374 tools, compared with 13,715 tools ground with the companion natural-diamond wheel.

In one of the production comparisons on Thompson surface grinding machines in the General Electric Detroit Plant, two vitrified-bond straight wheels (10 inches in diameter by 3/4 inch wide) of 100 grit and 100 concentration were evaluated. The man-made diamond wheel was 24 per cent better in this test, which involved the grinding of a wide variety of shapes and grades of Carboloy cemented carbide.

In a recent test, a pair of metal-bonded cup-shaped wheels were tested on an electrolytic grinder at General Electric's Edmore plant. These straight-cup wheels were 6 inches in diameter with a 3/4-inch wide rim, 120 grit, 100 concentration, and 1/16-inch diamond depth. In this test, the man-made diamond wheel was 33 per cent better than the natural-diamond wheel, in terms of cubic inches of carbide ground to cubic inches

Fig. 5. Vitrified-bond, plain-cup grinding wheel made with man-made diamonds, 120 grit and 100 concentration, with a 1/8-inch diamond depth. Wheel is 6 inches in diameter by 3/4 inch thick.

Summary of Wheel Tests

Test No.	Grinding Machine	Wheel Type	Wheel Size, Inches	Wheel Specification	Efficiency Ratios: Cubic Inches of Carbide Removed per Cubic Inch of Wheel Wear		
					Natural Diamond	Man-Made Diamond	Relative Grinding Efficiency*
1	Brown & Sharpe No. 2 Surface Grinder	D1T Straight	7 by 1/4 by 1/4	D100L100V-1/8	121.7	162.7	133
2	Thompson	D1T Straight	10 by 3/4 by 5	D100L100V-1/8	12.8	15.9	124
3	Brown & Sharpe No. 2 Surface Grinder	D1T Straight	5 by 3/16 by 1 1/4	D220N100B-1/8	113.8	136.4	120
4	Cincinnati No. 2 Tool and Cutter	D11B Flaring Cup	3 3/4 by 1 1/2 by 1 1/4	D150N100B-7	10.5	15.0	143
5	Hotpoint	D6WHC Cup	6 by 3/4 by 1 1/4	D120T100V-1/8	29.0	42.0	145
6	Hotpoint	D6WHC Cup	"	"	16.9	30.6	181
7	Hotpoint	D6WHC Cup	"	"	21.2	42.9	202
8	Hotpoint Electrolytic	D6WHC Cup	"	D120N100M-1/16	23.3	31.1	133

* Ratio of performance of man-made diamond wheel to natural diamond wheel multiplied by 100.

Note: While the comparisons between the efficiency ratios of the straight 7- by 1/4-inch and 5- by 3/16-inch wheels are valid, the efficiency ratios were noticeably higher than usually found in production grinding. These wheels were tested in the laboratory under closely controlled conditions. The wheels were not dressed after the test had begun, and there was not the usual intermittent contact between the wheel and the carbide normally experienced in production. A relatively large piece (12 by 2 inches) of Grade 883 Carboloy was ground.

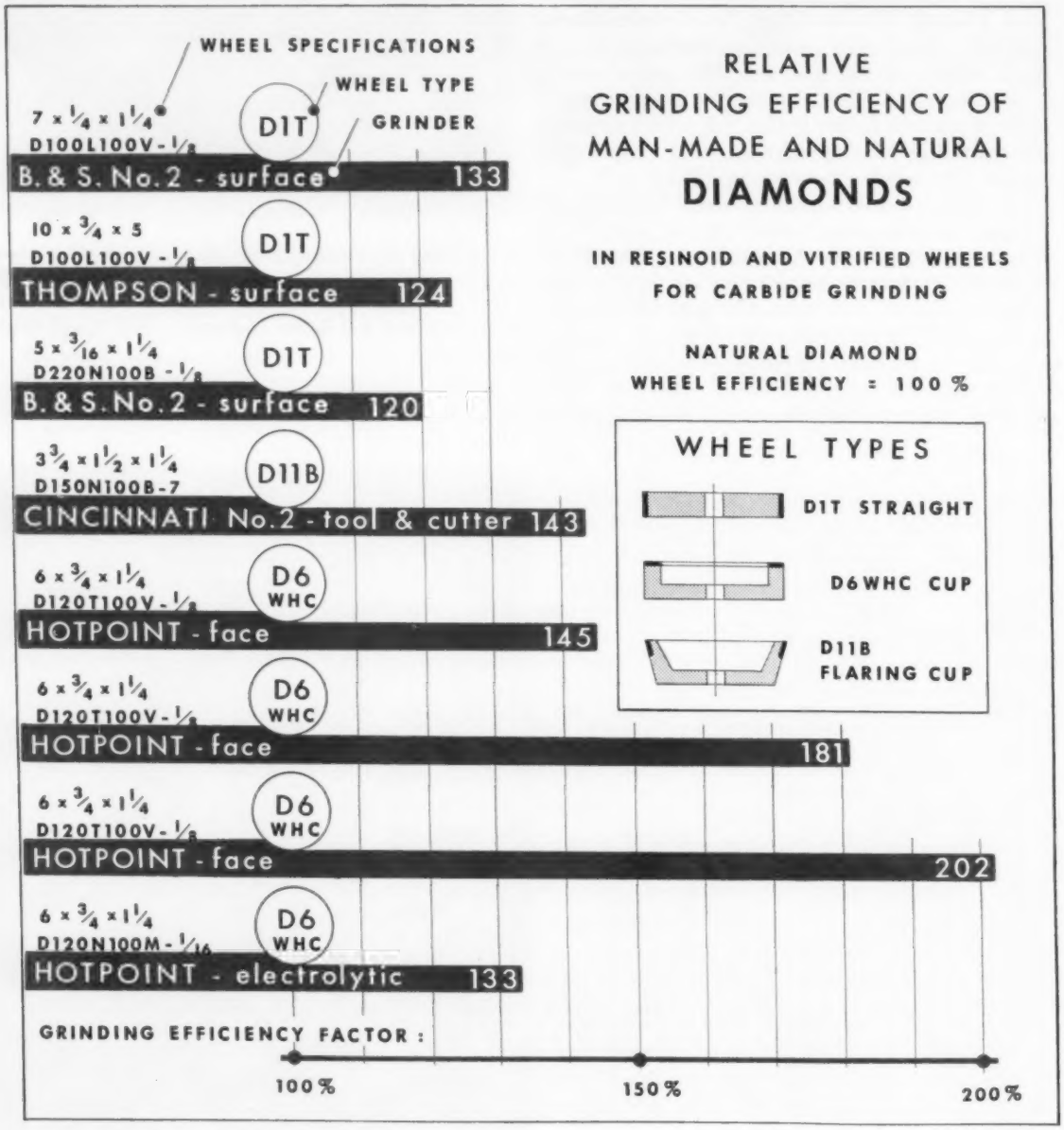
of wheel wear. In this type of grinding, even though a metal bond is used, relatively low unit pressures are applied by the work on the wheel.

In summarizing twenty-five closely controlled tests in both production and laboratory grinding, it was concluded that man-made industrial diamonds in resinoid- and vitrified-bonded wheels used for grinding carbide out-performed natural diamonds by an average of 35 per cent. Results of some of the tests are given in the accompanying table, and the relative grinding efficiencies of the wheels are tabulated in Fig. 6.

Why Should Man-Made Industrial Diamonds be Better?

Crystallographically, both man-made diamonds and natural diamonds are identical. Both give strong X-ray patterns that are indistinguishable from each other. Physically, however—and particularly in regard to crystal habit—there is a difference which may be readily detected under a microscope. The man-made diamonds are generally blocky, rough-surfaced crystals, with a small percentage of intergrown, dendritic, and

Fig. 6. Grinding efficiency of man-made diamonds in wheels of various specifications and types, and used on different machines, based on an efficiency of 100 per cent for natural-diamond wheels.



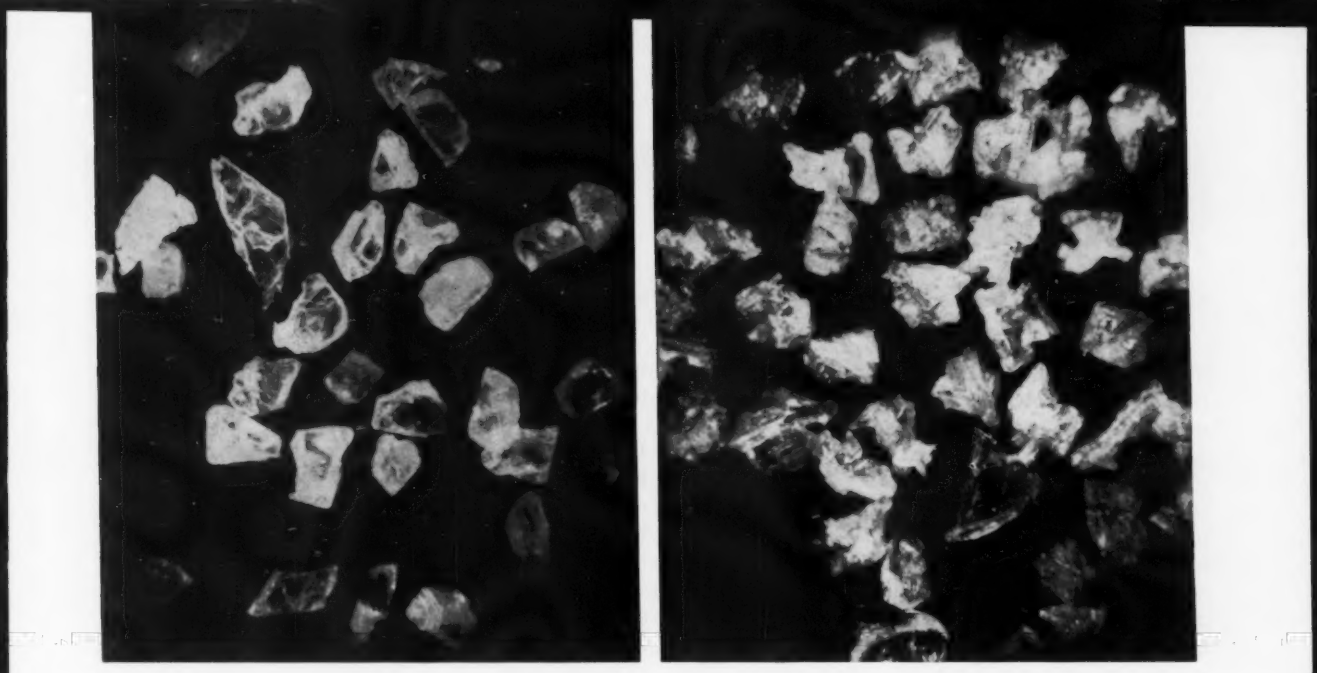


Fig. 7. Crystals of natural diamonds (left) vary widely in shape and are generally smooth surfaced. Man-made crystals (right) are generally blocky and rough surfaced. The crystals are 80 to 100 mesh, and are shown at about 40 magnifications.

skeletal type crystals. The natural bort, on the other hand, varies widely in particle shape from flat to blocky shapes, with some elongated particles, and are generally smooth surfaced. A comparison is seen in Fig. 7.

Since the man-made diamonds have a rough jagged surface, there is a better mechanical support of the crystals in the bond—resulting in less diamond loss while grinding. Another factor in the superiority of man-made diamonds is that they are more friable, having a tendency to fracture more readily and present new, sharp cutting edges. This results in a freer cutting action, lower power requirements, and greater carbide removal.

However, if the diamonds wear more rapidly, why do the wheels give longer life? This may be answered by combining this factor of more rapid breakdown of the crystal with the better mechanical bond. The man-made diamond crystals are held in the bond until they are more completely used. This compares with the tendency of natural diamonds to pop out when over half of the diamond protrudes through the bond surface. Another factor is the absence of splinters and flats in man-made diamonds. These shapes are inherently weaker than blocky crystals, and do very little actual grinding before they break off.

Current Limitations of Man-Made Diamonds

At the present time, man-made diamonds are limited to applications involving 80-mesh crystals (177 microns) and smaller. Superiority of such diamonds is most pronowncd with resinoid- and vitrified-bond wheels. The extremely high feed rates and high unit pressures existing in cut-off applications produce a degree of stress on the diamond crystals which the presently available friable man-made crystals cannot withstand. Several comparative trials with resinoid- and metal-bonded cut-off discs, having diamond crystal sizes varying from 60 to 220 mesh, produced inferior results to natural diamond in the cutting of glass, cemented carbide, tile, and granite. Similarly, the experience with metal-bonded wheel applications generally has not been comparable to natural diamonds except in the case of electrolytically assisted grinding of tungsten carbide previously referred to.

Thus, the major development problem in providing broader product coverage with man-made diamonds involves the production of somewhat stronger and coarser crystals to cover the range of 20 to 80 mesh. Also, stronger and more consolidated crystals are needed to function satisfactorily in metal-bonded wheels and cut-off discs in all size ranges of commercial interest.

Man-made diamonds are now available to grinding-wheel manufacturers, and any wheel user can order wheels with such diamonds. When pilot-plant production of man-made diamonds was announced October 22, 1957, the price was $4.25 per carat. Now, the price is $3.48, and it is hoped that further reductions will be possible to make them more competitive with natural industrial diamonds, which are about $2.80 per carat.

Carbide Tooling on Automatics

TUNGSTEN-CARBIDE TOOLS have been employed effectively for some time on single- and multi-spindle automatics at the Duston, England, plant of British Timken, Ltd. These machines are used to produce outer cups from tubing for the smaller sizes of the company's taper roller bearings. Because of the special shape of undercuts required in the raceways, machining of the inner cone members with tungsten-carbide tools has presented a number of difficulties not encountered in the production of cups. However, following recent development work, automatics equipped with such tools have been used successfully for this purpose with important savings in production costs.

Automatics now equipped with tungsten-carbide tooling include Acme-Gridley four-spindle, 4 3/4-inch capacity machines; Wickman four-spindle, 3 1/2-inch capacity machines; New Britain single-spindle, 4 5/8-inch capacity machines specially built for this type work; and special single-spindle 3 1/8-inch capacity machines designed for the purpose by the Timken Roller Bearing Co., Canton, Ohio. A general view from the rear of one of the New Britain single-spindle machines is seen in Fig. 1, and Fig. 2 shows the tooling area. This machine is equipped with an automatic arrangement for feeding the tubes.

Case-hardening, nickel-alloy steel tubing in 9- to 12-foot lengths is used for the bearing rings. Each tube is fed along a V-shaped support channel of the magazine by means of a roller-guided block *A* (Fig. 1). This block is attached to the lower run of a roller chain *B* which passes over sprockets and is driven by an air motor. Starting and stopping of the motor are controlled by a solenoid valve through a limit switch actuated from the camshaft of the machine.

Pusher-block *A* is provided with a freely rotating contact pad which bears against the face of a rubber-covered steel plug fastened into the end of the stock tube to prevent back-flow of the coolant. During the feed-stroke, the tube is advanced to a roller type stock-stop carried on a cross-slide seen at *C* in Fig. 2, which is moved into working position by a cam. A micro switch is provided to stop the machine when all of the tubes in the magazine have been fed.

The New Britain machine has three radial tool-slides and an end-working slide. The latter carries tools for machining and chamfering the tapered bore, and for turning the outer periphery. Front and rear rounded corners are formed in the periphery of the tube with tools mounted on the radial tool-slide *D*. The roller bearing cup is partially cut off by means of a tool on slide *E*. This tool is timed to come into operation in advance of the corner radii tools, thus machining a clearance groove in the tube.

Separation of the roller bearing cup from the tube is completed by a cut-off tool on slide *F*. The shape of the cup produced is illustrated in Fig. 3. A step is produced on the end face of the cup adjacent to the large-diameter end of the tapered bore. Then, when this face is subsequently ground to remove about 0.010 inch of stock, it blends with the corner radius.

Tool-holder *G*, carrying the boring and chamfering tools, is mounted on a vertical slide which is moved up and down by means of a cam on a longitudinal slide. This longitudinal slide is also

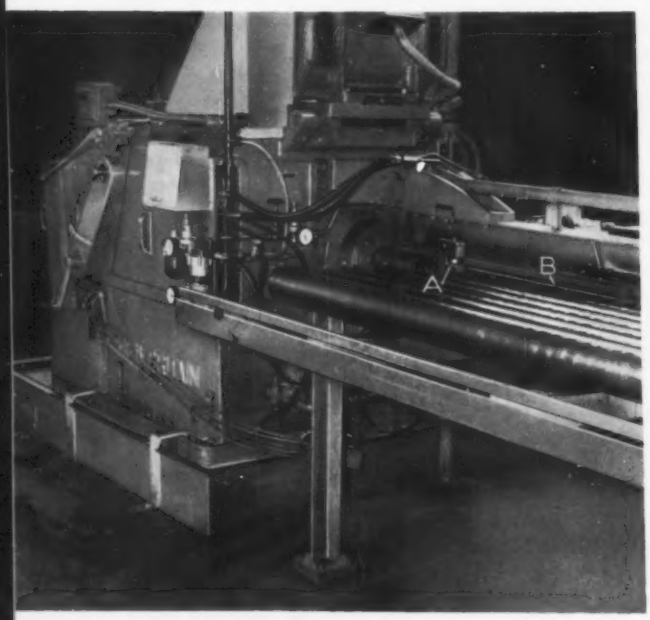


Fig. 1. Rear view of special single-spindle automatic showing automatic magazine feeding unit. The tube is pushed by block (A) mounted on chain (B).

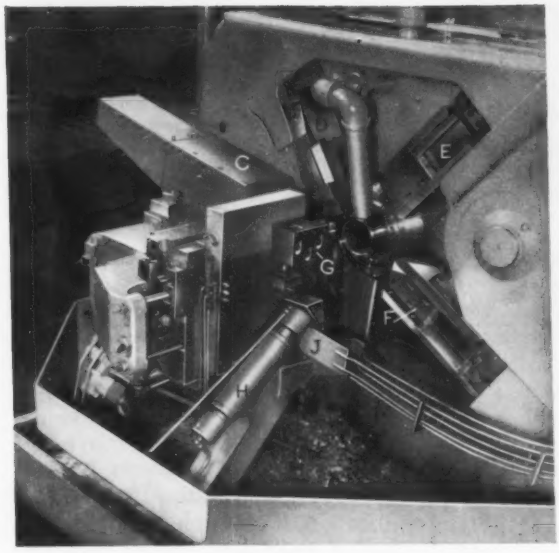


Fig. 2. Tooling area on the single-spindle automatic seen in Fig. 1. Tube is automatically fed against a roller type stock-stop on cam-operated slide (C).

traversed by means of a cam along guide ways on an extension of the machine frame, thus producing the required taper in the cup bore.

Upon completion of the boring and chamfering operation, the longitudinal slide is immediately retracted. When the tools are clear of the work, the vertical slide moves upward to its starting position. The tool for turning the outer periphery of the work-piece is also mounted on the longitudinal slide, to the left of and below the tool-holder *G*.

As the cutting-off operation nears completion, the plain-ended piston-rod of an air cylinder *H* (mounted angularly in the chip-pan of the machine) is advanced into the bore of the bearing cup. When the cup has been cut off, it slides down the piston-rod into contact with a buffer pad on the end of the air cylinder. Then, when the piston-rod is retracted, the cup is released into a guide channel *J* and rolls into a container at the rear of the machine.

Production has been expedited by pre-setting the corner and cut-off tools in special holders, Fig. 4, which permits rapid tool changes with a minimum of subsequent adjustment. The brazed tip boring tool *A* has a negative top rake of 5 degrees and is provided with a chip-breaker step which is reground each time the front face of the tool is sharpened. On the turning tool *B*, the negative top rake is 10 degrees, and a chip-breaker step is again provided. In the case of the internal chamfering tool *C* the top rake is zero, and there is no chip-breaker step.

The two half-dovetail, form-ground radius tools *D* and *E* are made of solid tungsten carbide. Tool *E* is located against a dovetailed face on the holder, and the spacing of tool *D* is controlled by a block *F*, which has a tapered face to match the taper on the side of the tool. Vertical adjustment of the block is accomplished by means of a bottom-mounted jack-screw. The assembly is clamped by means of two socket-head screws which draw in the wedge member *G*.

Backing screws are also provided for tools *D* and *E*, and oblique chip-breaker steps are ground in the tools each time their top faces are sharpened. Setting of the tools to the correct spacing and checking of the tool forms are done on a Jones & Lamson optical comparator by reference to a master drawing of ten times the size.

Brazed-tip parting tool *H*, 3/16 inch wide, has zero top rake and a clearance angle of 1 1/2 degrees at each side. This tool is clamped in its holder by means of a wedge plate and two socket-head screws. A similar type of holder is employed for the preliminary cut-off tool *J*, which is solid tungsten carbide and has a maximum width of 11/64 inch and a taper of 12 degrees at each side. Chip-breaker steps, 0.010 inch deep, are provided on both tools. Setting of the tools in their holders to the correct lengthwise positions is carried out in a fixture which incorporates a dial gage that is set to zero by means of reference blocks.

Cutting speeds up to 450 surface feet per minute are employed for these operations with a feed rate of 0.010 inch per revolution. With the high-speed steel tools previously used, the maximum cutting speed was 150 feet per minute. Also the tungsten-carbide tools permit an output

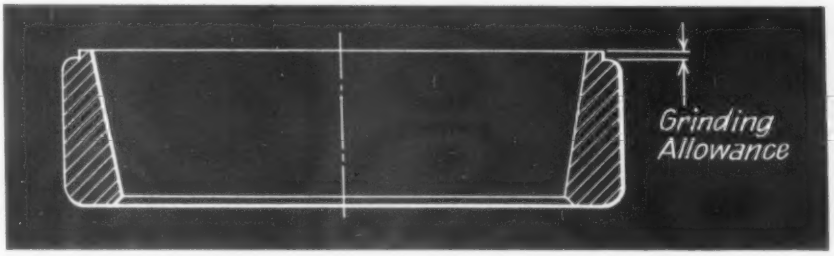


Fig. 3. Roller bearing cup produced from tubing on the single-spindle automatic seen in Figs. 1 and 2. Stepped face is ground flush with rounded corner.

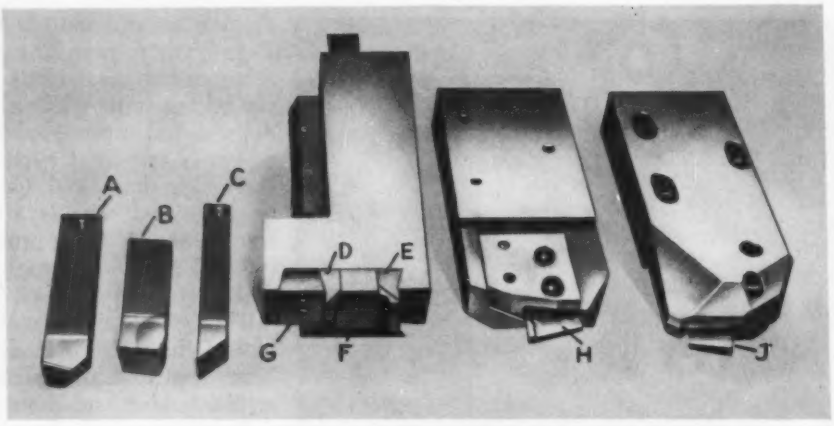


Fig. 4. Carbide tools for producing taper roller bearing cups include boring (A), turning (B), internal chamfering (C), radius (D and E), and cut-off (H and J).

between two and one-half and three times as great. The tools are changed after a predetermined number of pieces have been produced. For example, in making rings about 4 inches in diameter, the boring and turning tools are changed after producing 700 pieces; the cut-off tools, after 500 pieces; and the radius tools, after 300 pieces.

Close-up views of the front and rear tooling areas on one of the Wickman 3 1/2-inch capacity, four-spindle automatics are shown in Figs. 5 and 6. A cutting speed of 450 feet per minute and a feed rate of 0.014 inch per revolution are employed. At the first station the tube stock (not shown) is fed against a swing-stop *A* (Fig. 5). Here the outer periphery of the tube is rough-turned by means of a tool on the end-working main slide. Also, a breakdown tool *B* on the front cross-slide produces a groove to provide clearance for subsequent radius forming.

At the second station, the periphery is finished by plunge-feeding a cross-slide tool *C* (Fig. 6). Also, the tapered bore is rough-machined with a special Timken-designed, end-working slide which incorporates a cross-feeding tool-holder *D*. This holder is arranged to traverse during the forward movement of the slide to produce the required taper.

Forming of the two corner radii is done at the third station by means of solid tungsten-carbide, pre-set tools *E* on the overhead slide. Finish-boring is also performed at the same station with a second end-working slide *F* of special design. Finally, at Station 4, the front edge of the bore is chamfered by a tool on the independent end-working slide *G* (Fig. 5). Here also, the ring is cut off in two stages by means of pre-set tools in holders *H* and *J*. The completed part falls into a chute *K* attached to the main slide.

For sharpening the single-point boring and turning tools, the company uses a template-controlled form grinder, Fig. 7, built by the Oliver Instrument Co. Two flanks and the nose radius of each tool can be ground in a continuous pass under the control of a 2-to-1 ratio flat template. The template can be produced on the grinding machine from the tool itself or a corresponding master plate.

The tool *A* to be ground is clamped by means of a hand knob in an interchangeable adapter that is mounted in a detachable holder *B*. A hemispherical socket on the lower end of this holder is located on a hardened steel ball-ended

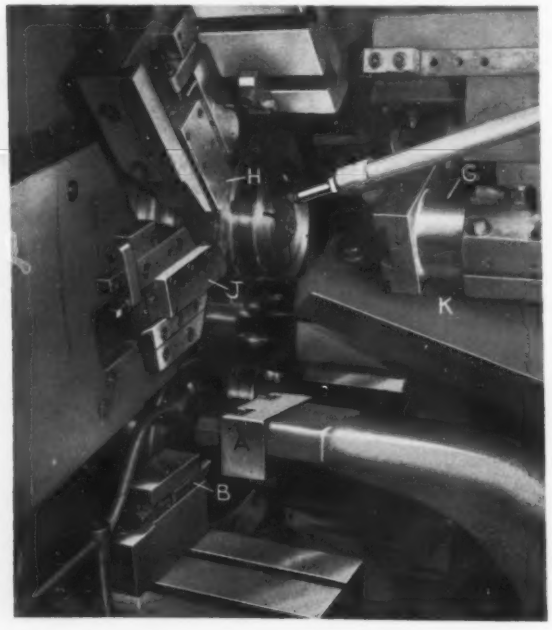


Fig. 5. Close-up view of front tooling area on four-spindle automatic. Completed bearing rings fall into chute (K) which is attached to the main slide of the machine.

stud carried on a vertical slide *C*. This slide is adjusted by means of the handwheel and screw *D* to position the tool at a specified height above the axis of the grinding wheel *E*, thus producing the required amount of front rake. A circular reference chart used in conjunction with a scale on the vertical slide indicates the amount of offset required for a particular rake angle.

A case-hardened template *F* made from 5/32-inch thick mild steel plate is located by means of a tenon slot and dowel on top of the holder, and is clamped with a knurled screw. When sharpening a tool, the template is manually held in contact with a flat, hardened steel plate *G*, attached to the vertical slide. In this way, the template form is reproduced on the tool at a reduction of 2 to 1.

Dressing of the grinding wheel is done with a special diamond holder (similar to the tool-holder shown at *B*), which is first located on a ball stud *H* fastened to the machine frame. This holder is fitted with a flat, hardened steel plate at its upper end. The plate is held against the face of a graduated, adjustable stop-screw *J* which has previously been set to zero. A truing diamond, located at the center of the holder, is then moved into contact with a datum pad *K*, and clamped. Dressing of the wheel is rapidly accomplished by moving the pre-set diamond holder about the ball stud on slide *C*. The entire vertical slide assembly can be swung backwards about a lower trunnion mounting when dressing.

For sharpening a tool, the holder is located on ball stud *H*, and the stop-screw *J* is moved outwards an amount equal to the stock to be ground from the tool. Then, the template is held in contact with the stop-screw, while the tool is adjusted up to the datum pad *K* and locked in place. Sharpening is then carried out by transferring the tool-holder to the ball stud mounted on slide *C*.

To produce a 2-to-1 ratio template from a master tool, the tool-holder is located on ball stud *L*, below the 5-inch diameter, cup-wheel grinding head *M*. The master tool, clamped in position at the center of the holder, is held in contact with a datum pad *N* fixed to the machine frame, while the template (mounted on top of the holder) is being form-ground. A special diamond holder with ball socket is provided for truing the face of the cup-wheel, and the wheelhead is adjustable transversely for applying the dressing cut.

The main tool grinding wheel on the machine is 20 inches in diameter by 2 inches wide, when new, and can be used down to a diameter of 14 inches. Coolant is applied centrifugally through the pores of the wheel, as well as by means of an external jet at the front of the hood.

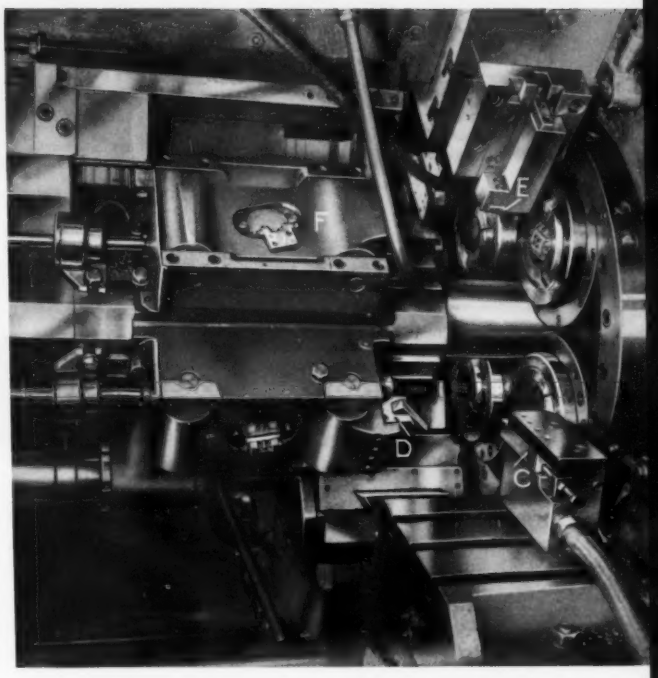
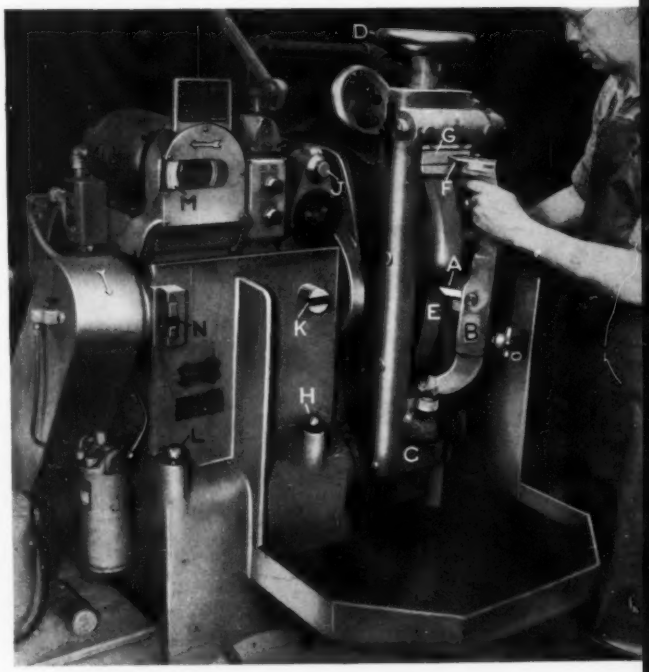


Fig. 6. Rear tooling on automatic seen in Fig. 5. Special end-working slides, such as one shown at (F), cross-feed the tools for taper-boring.

Fig. 7. Grinding machine used to sharpen single-point carbide tools employed on automatics. The tool is shown at (A) and the case-hardened template at (F).



"C.E.J." + "B.& S." = PRECISION GAGING

LITTLE BLOCKS OF STEEL—unimposing in appearance, yet embodying the highest degree of precision—have been the guardians of dimensional accuracy for science and industry since 1896. It was then that Carl Edward Johansson, a young Swedish government arms inspector, produced his first set of gage-blocks. Discouraged by the slowness of assembling rifle parts because of production inaccuracies, Johansson had persevered for years to produce a set of precision measuring standards which would be universally available.

Each "Jo" block is a rectangular piece of extremely stable steel, approximately 3/8 by 1 3/8 inches by whatever third dimension—the critical length—is specified. Blocks are classified according to the limits of accuracy of this length. The limits for blocks up to 1 inch, and for each inch of length on longer blocks, as set by the United States National Bureau of Standards, are as follows:

Class	Limits
AA	± 0.000002 inch
A	± 0.000004 inch
B	± 0.000008 inch

Blocks of varying lengths are generally furnished in sets, from which a great many gage sizes can be built up. From a typical eighty-four-block set, for example, 500,000 different gage sizes can be obtained—from 0.100 to 0.200 inch in 0.001-inch increments, and from 0.200 to over 12 inches in 0.0001-inch increments.

The extremely small limits to which block lengths are held are matched by a corresponding degree of flatness and parallelism of the measuring surfaces. So perfect are these surfaces that the blocks exhibit remarkable cohesive qualities when "wrung" together. For instance, a gaging combination like the one shown in the heading illustration will sustain a weight of 220 pounds.

Uses for "Jo" blocks are varied. As master laboratory standards they control meaurements in precision manufacturing. In the toolroom, they are actual working instruments of measurement. At the bench they are used to check inspection gages periodically. In conjunction with different accessories, the blocks check angles and locations. They may be used to set mechanical, electrical, and air comparators, or they may themselves be made into super-accurate height gages and snap gages or trammels for scribing lines and circles.

Brown & Sharpe Continues "Jo" Block Manufacture

Eventually, Johansson migrated to this country, and set up shop in Poughkeepsie, N. Y. When Henry Ford made the use of gage-blocks part and parcel of mass production in the early 1920's, it followed that Johansson's business activity would gravitate to Dearborn, Mich. There, in 1923, Johansson was placed in charge of the newly formed Johansson Division of the Ford Motor Co., in which capacity he carried on development of the gage-blocks until 1935.

With the concept of interchangeable manufacture spreading from the automobile industry to countless other industries through the 1930's and

1940's, demands for the blocks grew. It was a logical step then for the Brown & Sharpe Mfg. Co., Providence, R. I., to absorb their manufacture and distribution in 1948. Brown & Sharpe, (currently observing its 125th Anniversary), has been identified with the science of precision measurement ever since Joseph R. Brown invented the vernier caliper in 1851.

In addition to perpetuating the precision in Johansson's original creations, Brown & Sharpe has recently added a class of "Thrift" blocks. These blocks, produced to better than Class B accuracy, are priced to make their use by personnel on the shop floor and the production line entirely practical.

To create the new "Thrift" block line, the company worked backwards. First, a selling price considered attractive to a broad market was established. (Roughly, 50 per cent of the Class B price.) Then, using a committee approach, management and labor rearranged and streamlined manufacturing methods until production became economically feasible. Highlights in the production of these blocks appear in the accompanying illustrations.

The Technology from Bar Stock to Finished Block

Stock for the blocks is a high-quality chromium bearing tool steel. As a first step, bars of the steel are cut to 21 1/2-inch lengths, and sides and edges are brought to within 0.004 to 0.005 inch of size by surface grinding. Then the bars are further cut to blocks of required thickness, 0.020 to 0.025 inch oversize. After hardening to 67 Rockwell C, the blocks are stabilized by exposure to alternately low and high temperatures. This treatment prevents any tendency for the steel to grow or shrink.

Measuring surfaces are rough-ground in lots of seventy-two pieces. One surface is ground clean, then the blocks are inverted and the opposite surface is ground to within 0.003 to 0.004 inch of size. After sides and edges are finish-ground (approximately 0.358 by 1.375 inches), the blocks are loaded on pins against magnetic parallels, and the first measuring surface is spot-ground.

Blocks are inverted and placed in gangs between parallel bars, while the second measuring surface is ground. Again the blocks are inverted, and the first measuring surface ground until the blocks are 0.0016 to 0.0020 inch oversize. Demagnetizing and coating with a rust inhibitor follow. Preliminary operations are now completed and the blocks are placed in storage.

The exacting job of lapping the blocks is performed in a "room within a room," where temperature and humidity are carefully controlled. All six edges of the blocks are rolled on a bench wheel. Then, again in lots of seventy-two, the measuring surfaces are rough machine-lapped to within 0.00015 to 0.0002 inch of size. On a second machine, the surfaces are lapped to within 0.000020 to 0.000025 inch of size.

Fig. 1. The blocks are loaded in a spider which follows an eccentric path as it rotates between the laps.

Fig. 2. An electronic comparator in each cubicle is employed to control size during the machine lapping.

Fig. 3. The hand lapper strokes the block with a straight-line motion over a cast-iron plate.

One of the lapping machines appears in Fig. 1. The operator loads the blocks in a retaining disc, or spider, which rotates eccentrically with a cast-iron lap beneath it. (During the operation a second lap, seen to the operator's left, is aligned with the bottom lap.) The path followed by the spider as it rotates changes continuously, assuring the utmost flatness of the blocks.

The machine lapping is performed in three isolated cubicles, to keep all dust out of the hand-lapping area. Each cubicle has its own rough-lapping machine and finish-lapping machine. A superfine abrasive is used. There is an electronic comparator (Fig. 2) in each cubicle for controlling size.

Edges are buffed on a bench wheel to remove any burrs, and the blocks are ready for the high point of the entire manufacturing process—the hand lapping to plus 0.000006 minus 0.000002 inch of size. Each technician concerned with this step has a cast-iron serrated lapping plate, and is responsible for maintaining its accuracy. This is done by lapping it periodically with a master plate.

The blocks are placed in holders for the lapping, to isolate them from the heat of the technician's hands. A straight-line motion is employed. At intervals, the work will be picked up with tweezers and placed in naphtha to cool off. A view of the hand-lapping operation appears in Fig. 3. As in the machine lapping, electronic comparators are used to control size. Both processes also employ optical flats to inspect flatness.

Fig. 4. The surface finish of a lapped block is examined through eye-piece of an interference microscope.

Quality of the measuring surfaces is controlled by inspecting them with an interference microscope, Fig. 4. This device employs thallium light. Scratches as small as 0.000001 inch in depth will deflect the parallel bands observed through the eye-piece.

To etch the size, classification, and trademark in one surface of the blocks, they are varnished and set in a pantograph (Fig. 5) in lots of twenty-four. After the lines are scribed in the varnished surface, the blocks are etched with muriatic and nitric acid, applied with an eye-dropper. Ammonia is then used to neutralize the acid, the blocks are washed in naphtha, immersed in a rust inhibitor, greased, and wrapped in wax paper.

Processing is now complete, and the blocks are ready to be assembled into sets. Carbide wear blocks, 0.050 or 0.100 inch thick are available. By including these wear blocks as end members in a gaging combination, the steel blocks are protected, and their highly important function as industry's sentinels of accuracy is unimpaired.

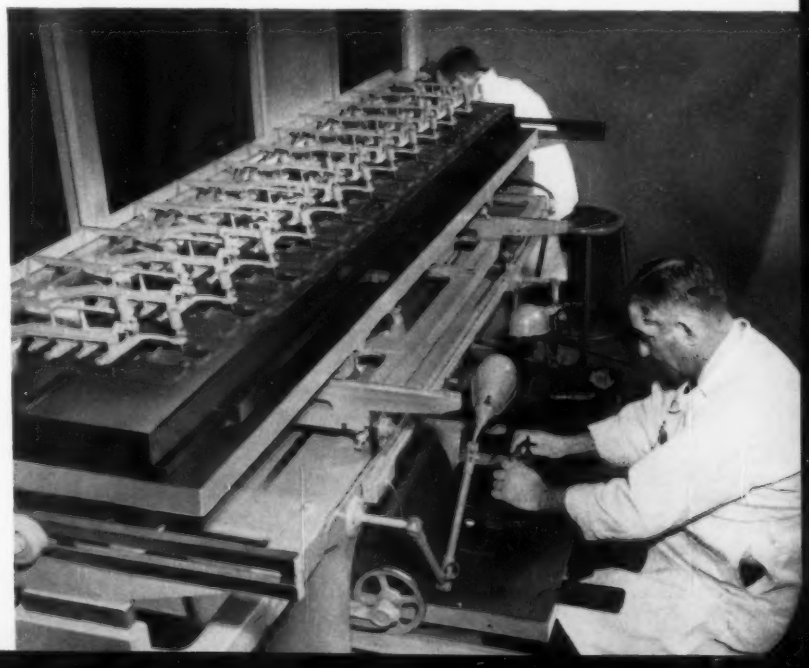
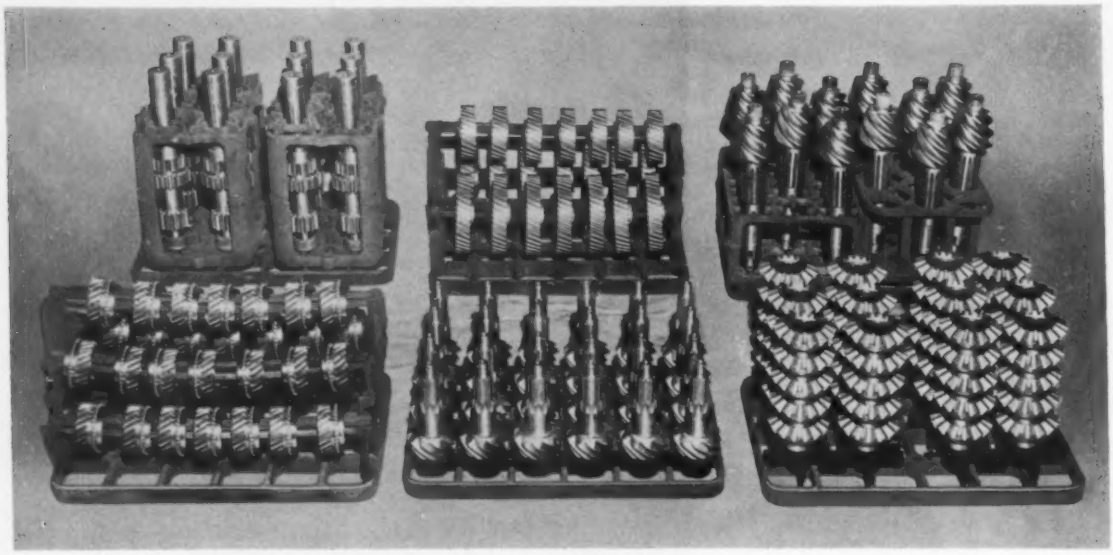


Fig. 5. A pantograph scribes the varnished block surface preparatory to etching the size, classification, and manufacturer's trademark.



Automatic Marquenching Solves Distortion Problem

WHEN CONVENTIONAL quenching methods resulted in excessive stresses leading to distortion of steel parts, International Harvester Co.'s Fort Wayne, Ind., Works developed a mass marquenching technique. This process of quenching in hot oil is being used with five continuous type, gas-fired carburizing furnaces, and exceptional results in both economy of operation and freedom from rejects are being obtained.

In the former gas-carburizing procedure, transmission and differential gears and kingpins were quenched directly in a "cold" oil bath (100 to 120 degrees F.). Distortion and warpage were extreme—on some shafts the runout ranged anywhere from 0.002 to 0.020 inch. These shafts were salvageable by straightening, but at the disadvantages of high cost for time and labor, plus the creation of stresses in the parts due to straightening.

Marquenching (hot-oil quenching) minimizes distortion in gears, pinions, and shafts by relieving the high stress conditions usually caused by conventional quenching methods, whereby parts are hardened from the outside in. Marquenching differs in that the core is hardened first, so that it can contract and expand without the hardened case restricting it in any way. After the part is removed from the quenching bath, the case area is hardened on top of the core. This double process is most effective in minimizing distortion in the heat-treating of heavily loaded parts.

In marquenching, the work-pieces are first quenched in oil maintained at a temperature (300 to 400 degrees F.) equal to or slightly above the initial transformation temperature at which martensite begins to form in the carburized case. The work is held in the bath just long enough to induce the best temperature equalization and to allow transformation of the core to martensite. The transformation of the case to martensite occurs when the work is removed from the bath and allowed to cool in air.

This procedure insures maximum temperature equalization throughout the work-piece. The sharply reduced stresses minimize subsequent distortion and loss of dimensional control. Heat-treated parts are straighter and have greater durability, and the service life of shafts and gears has been increased up to 200 per cent. Marquenching also eliminates the need for quenching dies, plugs for splined bores, and excessive manual handling during heat-treatment.

These results were achieved with the use of automatically operated, batch-loaded furnaces and a special-purpose quenching oil. The five furnaces are two-row carburizing units, and each furnace has twenty-one pushers per row and a gross weight capacity of 1000 pounds per hour.

An over-all view of one of the five furnaces is seen in Fig. 1. The furnaces are operated at different cycles to produce varying case depths, and are heated by radiant tubes with four-zone temperature control. Temperature in the first three zones is 1700 degrees F., and in the fourth, 1650 degrees F.

The first three zones of the furnace have an atmosphere of generated endothermic gas with a dew point of 0 to 10 degrees F. Natural gas is mixed with the generated gas in the ratio of 37 to 425 cubic feet per hour. In the last section of the furnace, 700 cubic feet of generated endothermic gas per hour is used. This gas has a dew point of 25 to 30 degrees F., and no additional natural gas is added to the atmosphere. The purpose of the atmosphere is to produce a very rich case and to allow time for diffusion to bring the carbon content to 0.85 to 0.90 per cent. This concentration of carbon in the case results in parts with maximum hardness.

Parts to be heat-treated are loaded on special cast-alloy fixtures, Fig. 2, designed to reduce the distortion of the parts. The particular design of each fixture is dependent upon the shape of the part. For example, pinions are located vertically, and larger gears are loaded horizontally so they will be less subject to heat distortion in the furnace. Each part has been carefully studied to determine the best type of fixturing that will permit it to remain straight during the heating process and to receive a good quenching.

Loaded racks of parts seen in Fig. 3 are ready to be pushed into the furnace. The heat-treating cycle is such that the parts are heated to 1700 degrees F. and maintained at this temperature for enough time to allow sufficient case depth. For a 0.040-inch case depth, the parts will remain in the furnace for seven hours. This is the cycle for practically all grades of steel used—SAE 4817, 8622, 8627, and 4118. All parts are hardened to a minimum of 57 Rockwell C. There are four different case depths produced, the shallowest being 0.031 inch and the deepest, for differential drive pinions, 0.080 inch.

Temperatures in the furnaces are reduced to 1650 degrees F. before quenching. The fixtures are pulled out of the furnace manually, by means of a hook, and into a vestibule which prevents air from contacting the parts. Then, the parts are lowered into the quench tank for a period of six to ten minutes, the exact time depending on the cross-section of the parts. About 80 per cent of the work is subjected to a six-minute quench, but parts having cross-sections thicker than 2 1/2 inches require a ten-minute quench. The quench cycle is automatically timed before the parts are brought up into the quench hood. The outer door is raised, and the parts are removed. They are then placed on a cooling rack for a period of four hours before they are washed. The principal reason for the cooling period after quenching is to permit transformation, since the case is quenched in air only.

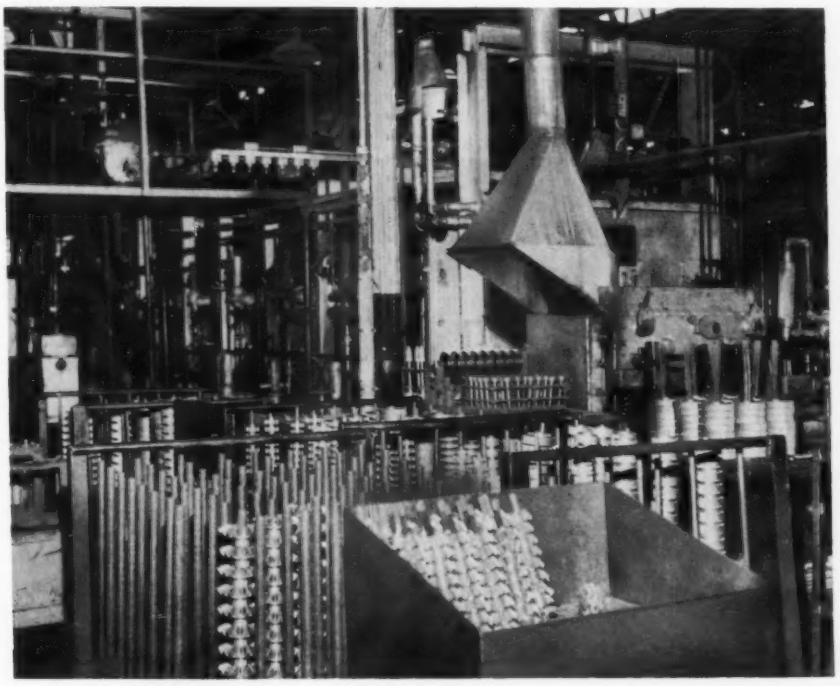


Fig. 1. Over-all view of a continuous type, gas-fired carburizing furnace for casehardening of transmission and differential gears.

The quench tank holds 1200 gallons of Shell Oil Co. Voluta 972 at room temperature. When the temperature of the oil is raised to 400 degrees F. for marquenching, the amount of oil in the tank rises to 1400 gallons. The tank has an overflow that allows the oil to drain to a small storage tank having a capacity of about 200 gallons. This permits the unit to be filled when cold and to form a seal for the atmosphere. When the oil is heated, the overflow of 200 gallons is returned to the reserve tank again for the start of a new week's operation.

The quenching oil is heated by six radiant tubes, three on each side, which are heating or cooling constantly as required. The temperature of the oil is controlled by thermocouples located between the agitator and the quenching trays. In this way, the temperature of the oil being directed on the work is measured.

Agitation of the oil occurs only during quenching. Previously, without a protective atmosphere over the oil-quench tank and full-time agitation, the life of the oil was approximately 400 hours. When the setup was changed to agitate only during the quench, the oil life was boosted to over 1000 hours. Now, with the addition of an

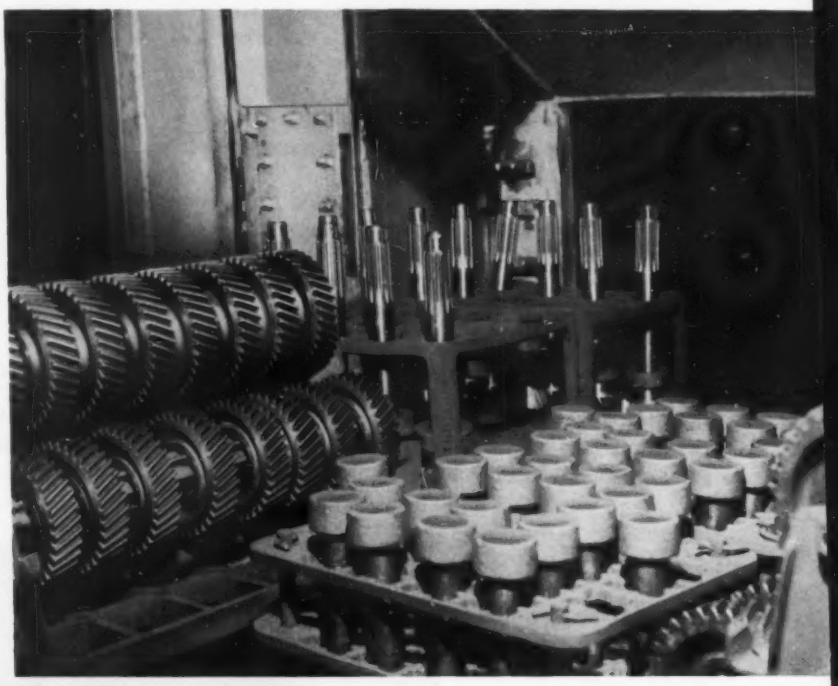


Fig. 2. (Right) Special cast-alloy fixtures have been designed for different shaped parts in order to prevent distortion and to insure thorough quenching.

Fig. 3. (Left) Fixtures loaded with shafts and gears are ready to be pushed into atmosphere-controlled furnace held at a temperature of 1700 degrees F.

Fig. 4. Steel shot-blasting is employed to clean heat-treated gears on this rotary-table machine. Finished gears are then inspected and tested.

atmosphere over the oil (the same atmosphere as in the furnace), the life of the Voluta oil has been boosted to an average of 10,000 hours.

In one quench tank, the oil has been used for a total of 16,941 hours. When the oil was placed in this tank in November, 1954, it had a viscosity of 89.1, and in August, 1957, the viscosity was 107.8. In the performance evaluation tests on the Shell Voluta 972, the oil lasted for 27 months before it became necessary to change. During this period, covering 9466 hours of quenching, 2,659,946 pounds of material were processed. Drag-out loss is very little, amounting to about 400 gallons in a year's operating time (6000 hours).

Heat-treated gears are cleaned by blasting with steel shot, as seen in Fig. 4. After finishing, the parts go to inspection for a percentage check of their hardness and a verification of other specifications. Parts are tested by dynamometers, under maximum calculated stress load for one million cycles, to determine life characteristics. Load-carrying capacity has been increased 20 per cent according to the dynamometer tests. From inspection, some parts go to the machining division where their bores are ground, and others are ready for immediate usage.

Parts are also regularly submitted to the laboratory for cutting apart and checking of the various case depths by both visual measuring and Tukon hardness tests. In addition, test pins are placed in the furnace. These pins are reheated to 1475 degrees F., quenched, broken, and etched with acid. It is then possible to determine the case depth on the pin, which indicates the case to be expected on the parts.

An Old Alloy with Young Ideas

Many centuries ago, a highly advanced Chinese civilization developed and produced a copper-base alloy which they named "packfong." Since the new alloy was white in color and was composed of copper, nickel, and zinc, the assigned name, meaning white copper, was appropriate.

Nineteenth-century German scientists refined the alloy to meet the demand for a metal that would resemble silver but would be far less expensive. Although still widely used as a substitute for silver and as a base metal for silver-plating, the improved packfong of ancient China, now called nickel silver, is being used for many other industrial applications.

A survey recently conducted by the Riverside-Alloy Metal Division, H. K. Porter Co., Inc., Riverside, N. J., pointed out some of the present-day uses of this age-old metal. Everyday applications of nickel silver include electrical contacts and springs in household light switches, engraved scales on barometers, watch bands, and hilts on sporting knives. The alloy also finds widespread use in the field of radar and other types of electronic systems.

Double-End Machining of Unwieldy Castings

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LARGE malleable iron castings are processed on double-ended boring machines in one plant of the Clark Equipment Co., Jackson, Mich. The castings are axle adapters for fork-lift trucks and are similar in shape to tee fittings for large-diameter pipe. Except for manual loading and unloading, all operations performed on these machines are completed automatically.

For the most part, boring and facing in and around the three openings in the castings are done on Heald Bore-Matics and on special machines that employ Heald Red Head units. Several diameters have to be held to within plus or minus 0.001 inch of their nominal size. Initial machining, however, is the facing of the flange at the central opening (parallel to the long axis) on a milling machine. This is done partly to provide a flat face against which the casting can be clamped and located for subsequent operations.

After this face is clamped against a knee fixture (Fig. 1), the boring operations for the rough- and finish-counterbore of the mounting face and the finish-drilling of a dowel-pin hole are performed on the flange. Then the casting is transferred to a double-end boring machine (Fig. 2) where the work is mounted with the same flange face clamped against a knee fixture on the machine table. This fixture holds the casting with its long axis in line with the axis of the two machine heads, each of which has a special spindle-mounted tool-holder. While clamped in this position, the casting is advanced first toward one head and then the other, as rotating carbide tools perform rough-turning, boring, facing, and

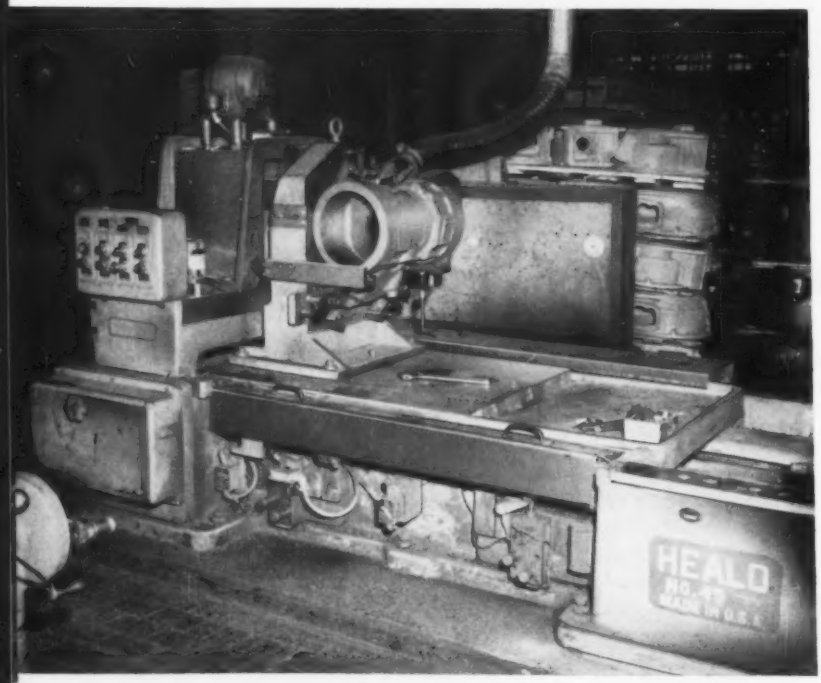

Fig. 1. In this single-end boring machine, the casting is fed to the spindle-mounted carbide tools that rough- and finish-counterbore one face, and finish-drill a dowel-pin hole in this flange.

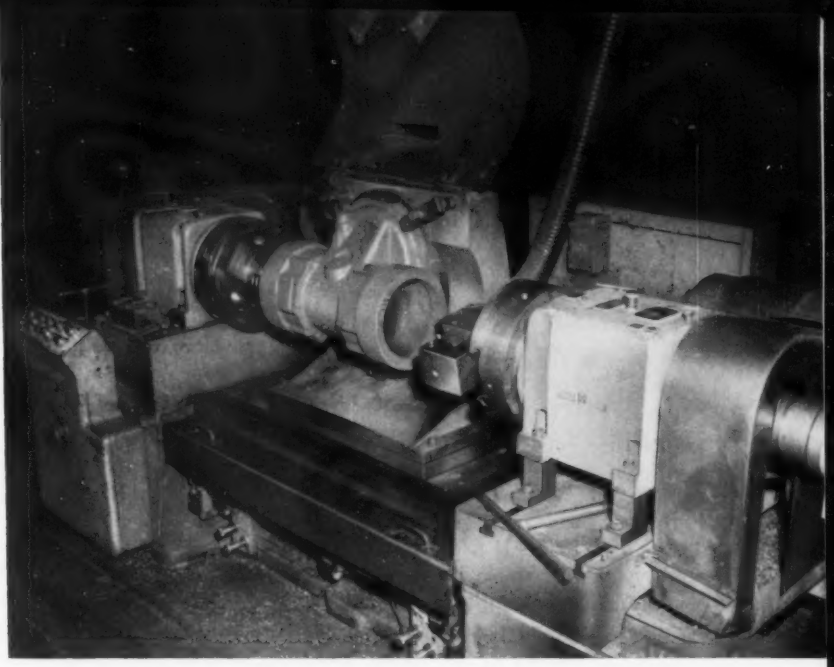

Fig. 2. Roughing cuts on opposite ends of the casting are made in this double-end boring machine. The work-piece is first fed to tools on one spindle and then to the set on the other spindle.

counterboring operations on the two ends. Upon completion of these roughing cuts the casting is similarly mounted in a second double-end machine for finishing cuts on the same surfaces.

Tools on second machine, Fig. 3, finish-turn periphery of each end, counterbore the inside of the hole adjacent to the ends, face the ends, bore the inside holes, and face the inside flange. For final facing cut, during which the tool travels radially about 1 inch, radial motion is imparted by means of a cross-slide on the tool-holder. This slide is advanced and retracted by a cam that is operated through the center of the spindle. There are only five tools on each head, including those that make chamfering cuts.

When started after loading, the boring machines operate automatically, and it is possible for all three to be operated by one man who, in general, does only loading and unloading. Considering the number of cuts and the close tolerances to which the dimensions are held, machining cost per casting is unusually low.

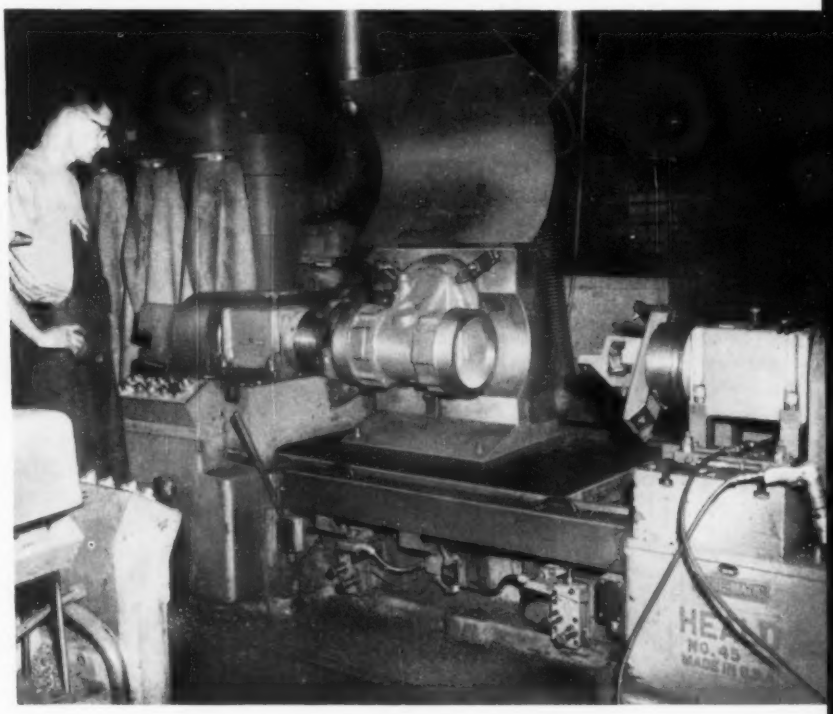

Fig. 3. Both ends of the casting are finish-turned, faced, and counterbored. At each tool-head, a cam activated through the spindle operates the spindle-mounted slide carrying the facing tool.

Tooling with Plastics

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Small Aircraft Engine Department
General Electric Co., Lynn, Mass.

DEVELOPING AND PRODUCING small aircraft engines present a definite challenge to the ingenuity of tool engineers. To help maintain a competitive position in this ever-expanding industry, the General Electric Co. recognized that quality tooling must be produced quickly and economically. Small aircraft engines require close-tolerance parts so intricate that the method of making the first few parts without tooling could not be utilized on the majority of components. In overcoming this problem, a new approach to tooling was taken, and the application of plastics to tool and die manufacture was evaluated and adopted. Experience to date with the use of plastics has resulted in substantial savings for practically every case, and in some instances, an 85 per cent saving in the cost of a tool has been realized.

Various kinds of plastics are available for tooling applications. The most common of these are polyesters, phenolics, and epoxies. Although the first two types have found limited use, the epoxy-base plastics fulfill approximately 95 per cent of the plastics tooling requirements at the Small Aircraft Engine Department of General Electric. There are various types of epoxy resins and hardeners which, when mixed in the proper proportions and cured at room temperatures for a specified number of hours, will produce a stable plastic material. The materials to be used will vary with the requirements of the tool being manufactured.

Many interesting applications of plastic to tooling have been encountered in the production of small aircraft engines. Turbine buckets and compressor blades are the subject of a large number of tooling problems. In most cases, tools involving airfoil contours if made of steel become prohibitive in cost. But, through the use of plastics, tooling for these parts has been produced which in the past would not be considered economically practical. For example, compressor blades can be held by their airfoil sections for milling, grinding, and checking the dovetail ends. This is easily accomplished by molding a plastic fixture around the blade airfoil section. As a result, plastic milling fixtures for compressor blades have replaced the conventional steel guillotine type design and are manufactured at one-tenth of their cost. These fixtures have saved days of tool-production time.

A major tooling requirement in the forging

Fig. 1. (Below) This type of plastic knockout has replaced similar steel parts in trimming dies used on compressor-blade and bucket forgings.

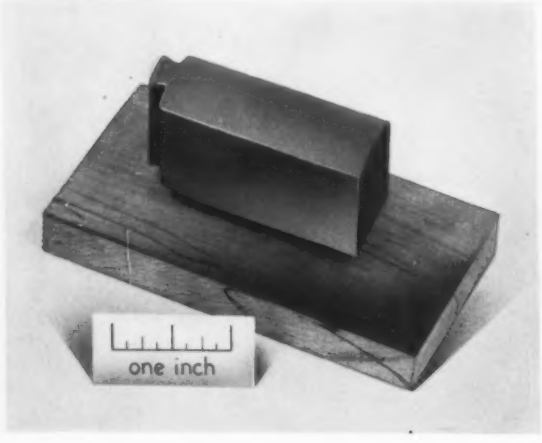


Fig. 2. (Above) Inaccessible internal splines can be easily inspected by checking a cast plastic model of the splined section.

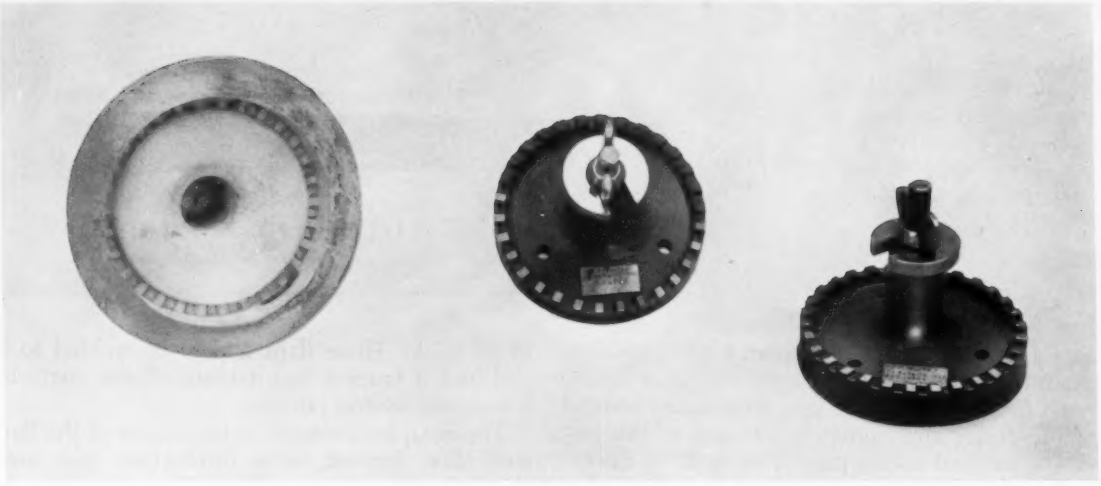


Fig. 3. Plastic holding fixtures (right) are employed for sub-assembly operations on compressors. Master mold is at left.

of compressor blades is trimmer dies. The knockouts for these dies were made of steel and required the skill and time of a high-priced diemaker. An investigation showed, however, that more uniform plastic knockouts, Fig. 1, could be made with an 80-per-cent savings in cost. A simple but interesting application of plastics involved a fixture for an accurate stamping operation on the top side of turbine-blade platforms. The part is located by the dovetail and maintained in a vertical position. In this case, the use of reinforced plastic saved the manufacture of a costly steel tool. Tumbling fixtures, benching and polishing blocks, die models, scribing and saw fixtures, electro-etch marking blocks, grinding fixtures, honing tools, and inspection aids make up a partial list of plastic tooling for the manufacture of turbine buckets and compressor blades.

In most of these plastic tooling applications, the advantage obtained was an accurate and economical tool that was produced in much less time than a steel counterpart. Plastics, although used mostly for tool manufacturing, have a definite and important place in inspection operations. Past experience has proved that, in this field, there are a large number of potential applications for plastics and that if they are properly used, many dollars and hours of valuable inspection time can be saved. A typical example of plastic applied to inspection involved the checking of an internal spline on a pinion for a small gas turbine. It was practically impossible to measure this spline either optically or mechanically, but by simply using the part to make a plastic model of the spline (Fig. 2), the problem of checking became quite simple. In this case, use of a plastic having practically no shrink made it possible to obtain an extremely accurate duplicate of the spline.

Another example was the production of an inspection fixture for checking the length of a compressor blade. The fixture required the proper contours to hold the part and maintain the correct relationship between the dovetail and the blade airfoil. The low cost of this plastic fixture made it possible to justify the purchase of other such aids. Airfoil inspection tools, spline-checking fixtures, and contour-checking tools are among the many plastic inspection aids, the use of which has resulted in substantial savings and improved part quality.

Plastics have also been applied to tooling for in-process, sub- and final-assembly operations. The two major reasons for a large demand for plastic assembly tools are: first, the type of tool required is readily made with plastics; and secondly, such tools are durable and lightweight. Examples of simple but dollar-saving assembly tools are illustrated in Fig. 3. Each of these fixtures was required to perform a sub-assembly operation on a rear compressor shaft and had a spline for locating the production part. As a large quantity of these tools were manufactured in plastic for approximately 20 per cent of the cost of comparable tools, a sizeable saving resulted. In assembly operations there is a great demand for various odd-shaped wrenches. One of these, involving a spline configuration, is seen in Fig. 4. This tool was readily made by molding the spline shape from the production part. With the master mold available, similar tools can also be made on short notice at low cost.

Plastic guide pins used at assembly were orig-

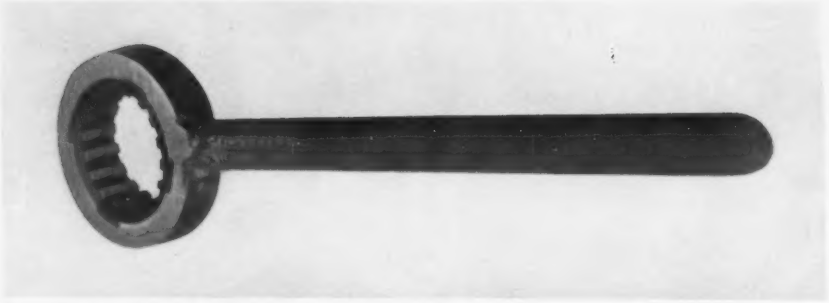


Fig. 4. Wrench having an insert that has been formed of plastic by using one of the production parts as a mold.

inally a two-piece construction, made of a steel pin and a brass bullet nose. By making a simple mold in a paper cup, the pins were manufactured of plastic for approximately one-fifth of the cost of the original metal pins. This type of plastic tooling, besides being economical and producible on short notice, eliminates the danger of marring the parts during assembly.

In addition, many welding and machining fixtures and dies have been successfully manufactured. As an example, a welding fixture was required for a small-quantity development lot of tail-flap sub-assemblies. The major concern was to manufacture a fixture quickly while keeping tooling costs to a bare minimum. This problem was answered with a plastic fixture (Fig. 5). Having the product parts on hand made construction of this fixture all the easier. The main part of the sub-assembly is a flap made of sheet metal with intricate double contours that meet at an angle. These flaps had to be welded to a pad and a bracket maintaining all the parts in a common central position.

The complex contours at the angles of the flap were first formed on a production part and checked out with templates. Then the base of the fixture was molded to this model part, at the same time leaving cored holes in the proper position for entry of the tack-welding electrodes. A laminated construction was used for the fixture, and plastic tubing for the cored holes. Stops and clamps were added where necessary to complete the fixture. A net savings of approximately 85 per cent was realized in the over-all cost. Furthermore, this tool was completed and delivered to our manufacturing area in approximately one-fifth of the time it would have taken to manufacture a steel fixture for the same operation. Oddly enough, this application served two important purposes. It not only solved a manufacturing problem but the favorable results obtained with this type of tooling impressed the manufacturing group so much that similar and additional fixtures were ordered.

Some of these additional tack-welding fixtures presented a slightly different problem since no production parts were available. In this case, brass templates were made from the working drawing and set on a common base. From this setup, a model was quickly constructed and the making of the final fixture became a minor problem.

Another application involved the manufacture of a drill jig (Fig. 6) for an aluminum cover having an odd configuration with seven unequally spaced bosses and numerous holes. The main problem was to hold the part rigidly and accurately for drilling. This was easily accomplished by first making plastic castings of the male and female contours from a production part. Then, with a few simple jig-boring and

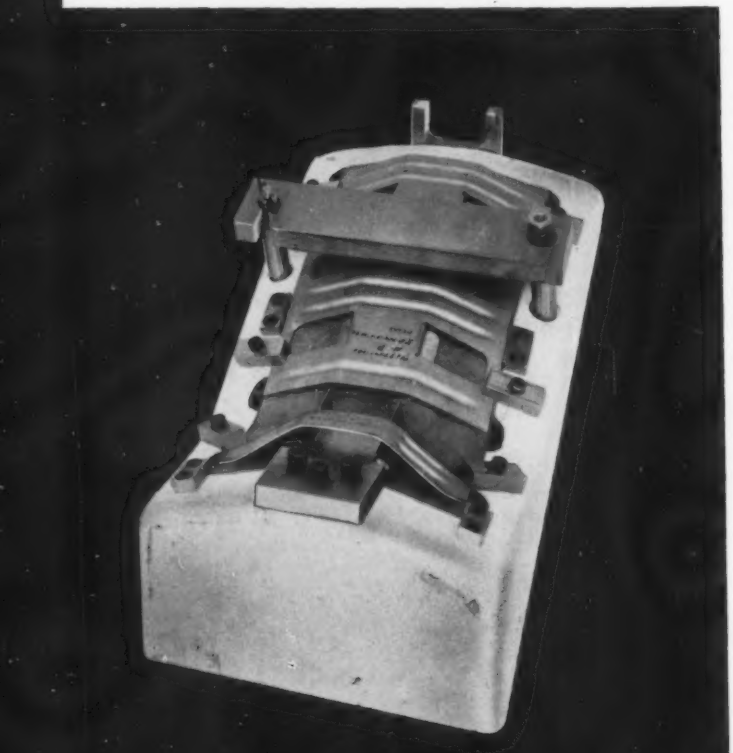


Fig. 5. This plastic fixture is used to hold tail-flap sub-assemblies for tack-welding. Top surface of the fixture base was molded to a model part.

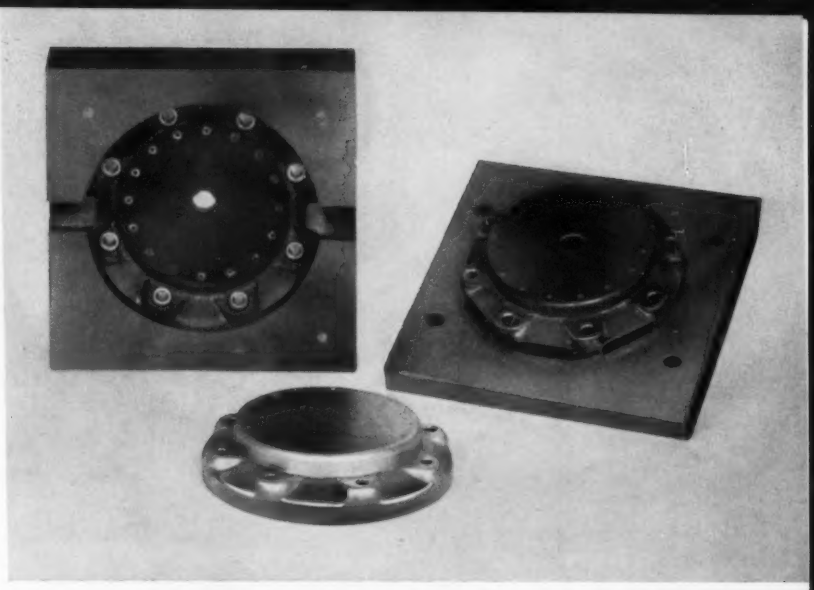


Fig. 6. Aluminum cover (bottom) is drilled in this two-piece plastic jig that was made from castings of the top (left) and bottom (right) of a work-piece.

assembly operations, a very accurate lightweight drill jig was constructed at approximately one-third the cost of a steel tool for the same purpose. Numerous other applications of plastics have been made in the manufacture of machining fixtures with excellent results.

To complete a cross-section of plastic tooling in the small aircraft engine department, applications in the field of die manufacture must be covered. Here, without any question, the greatest amount of resistance to the introduction of plastics was evident. Perhaps the traditional belief that dies could stand up only if made of steel played an important part in this rejection movement. However, since the ultimate result would be that dies could be manufactured at lower cost and in a shorter time, the use of plastic dies could not be denied, especially in this development program with its tight production commitments. After close scrutiny and evaluation, plastic tooling was applied to press and draw-hammer operations.

One of the first dies manufactured involving plastics was a crimping die for an outer combustion liner which, because of the shape desired, was quite simple to duplicate in this material. As a result, the die was manufactured for 50 per cent of the cost of a similar steel die. A piercing die for a cowl proved to be another successful plastic die (Fig. 7). By using the part for molding purposes and inserting a steel punch and bushing in the plastic before assembling these units to a die set, a properly contoured plastic die and punch were produced. This piercing die was manufactured at an approximate 75 per cent saving. Another simple die, involving plastic, was for a tube-forming operation. A master part was constructed and used to mold the upper and lower members of the die. By assembling these members to a flat steel plate, this die was com-

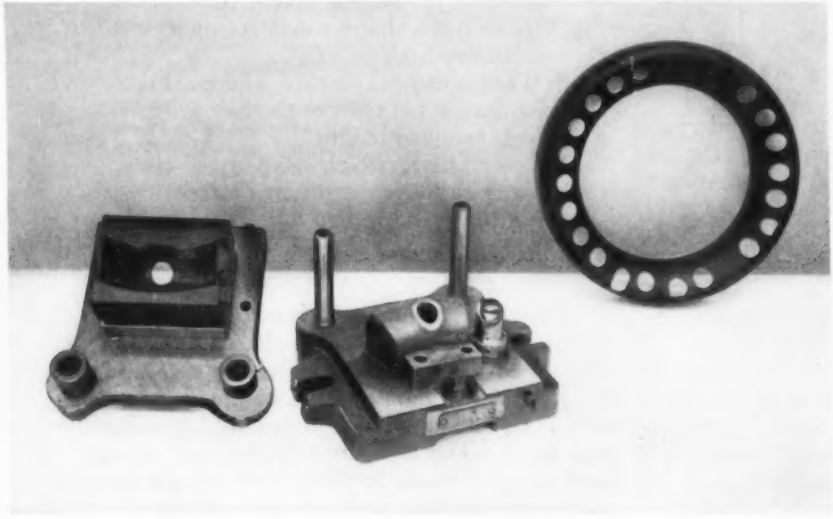


Fig. 7. This die, used for piercing a cowl (right), is molded from the part and is provided with steel inserts as the cutting members.

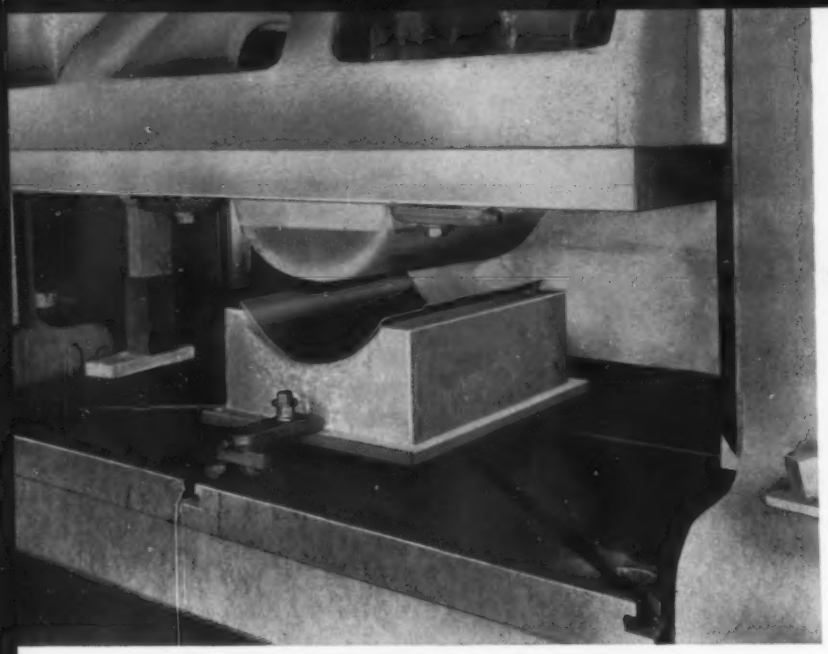


Fig. 8. Here a stainless-steel part is about to be formed in a drop-hammer die. Punch has facing of resilient plastic and die is faced with cast plastic.

pleted in one-tenth of the time and at 33 per cent of the cost of an all-steel die.

A final illustration of the application of plastics to dies is the manufacture of a drop-hammer die (Fig. 8) for forming an 0.030- to 0.040-inch thick stainless-steel part. This job required the making of a splined plastic master which was used to produce both the punch and die. The punch was made with a facing of resilient plastic and the die with a face of cast plastic. The savings on this project were quite substantial and, in addition, any repair or revision of the plastic die is relatively simple. There are many potential applications of plastic dies for drawing and piercing operations, and a more frequent use of such dies is contemplated.

As in the application of any new product or process, its advantages and disadvantages must be thoroughly understood and recognized. One of the major pitfalls in using plastic tooling is the failure to recognize its limitations. Although neither the panacea for all tooling nor a replacement for present materials, plastic when applied properly can be entirely satisfactory and more economical in many cases. To be realistic, the following are some of the inherent disadvantages that must be recognized:

1. Metal chips can become embedded in plastic tools.
2. Glass cloth laminate has a tendency to dull cutting tools.
3. Plastic tools wear more quickly than steel unless inserts are placed at critical wear points.
4. Unlike metals, epoxy resins are thermosetting and cannot be remelted and re-used.

Plastic tooling, however, has many advantages and here are some to be considered:

1. Generally, tools can be made of plastics at lower cost than comparable tools made from metals.
2. Plastic tools are easier to handle and usually have a weight approximately one-seventh that of steel.
3. Since plastic is formed while in a fluid state, the material is ideal for duplicating irregular or complex shapes.
4. Plastic tools can be modified by a relatively simple process.
5. Epoxy resins are very easy to use as the ingredients require no complex measuring and only the mixing of a hardener into a resin.
6. Because of their low shrinkage or expansion properties, epoxy plastics can reproduce a shape, model, or mold with relatively high accuracy.
7. When epoxy plastics are reinforced with laminations of glass cloth, they will have high tensile strength.
8. Except those which are very abrasive, epoxy resins are easily machined.
9. Epoxy resins are non-toxic after curing.
10. Epoxy resins will bond to any surface which is properly prepared.

Since this is a comparatively new field, the number of disadvantages should decrease in time, and the advantages should increase correspondingly. There are almost always skepticism and resistance to the application of tooling innovations because of a lack of knowledge of their advantages and potentials. In plastic tooling, one must plan an approach to overcome this attitude.

MATERIALS

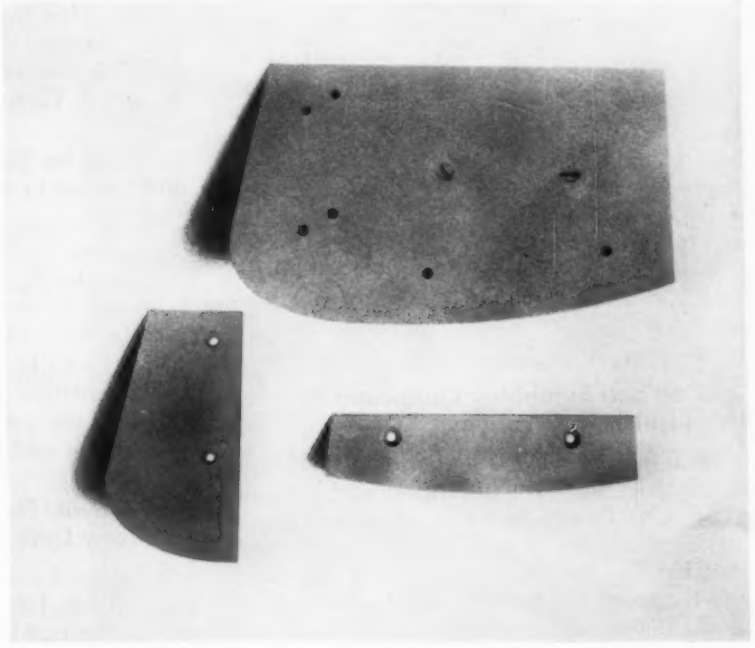
The properties and new applications of materials used in the mechanical industries

Corrosion-Resisting Plastic Bar Stock for Machined Parts

A rigid polyvinyl chloride industrial plastic has been made available in bar form by Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill., for automatic screw machine production of corrosion-resisting parts. Sold under the trade name "Ryertex-Omicron PVC," the plastic is said to machine like brass. The equipment and methods generally employed with steel, light metals, or wood are also suitable for machining this material. Sizes of stock range from 1/4-inch to two-inch rounds in 10-foot lengths. It is also available in larger sizes in 20-foot lengths. Diameter tolerances through 1-inch rounds are plus or minus 0.005 inch; over 1 inch and up to and including 2 inches, plus or minus 0.010 inch; and over 2 inches, plus or minus 0.015 inch. Parts that have been machined from this stock include sealers, valve components, and fasteners which are used in applications where a non-corrosive material is required.

Composite Adhesive Films Used in Honeycomb Sandwich Construction

The Adhesives, Coatings & Sealers Division, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich., has brought out two composite film adhesives for bonding honeycomb sandwich construction. These composite adhesive films, called "Scotch-Weld Brand Bonding Films AF-200 and AF-201," have a high-strength elastomeric adhesive film on one surface and a self-filleting adhesive film on the other. The elastomeric adhesive bonds to the facing and the self-filleting adhesive bonds to the core of the honeycomb sandwich panel. These formulations maintain their strength in service temperatures



The two smaller parts shown here are replaceable mixer-plow wear parts made of "BR-4" steel, which, according to its producer, the Special Products Division, Latrobe Steel Co., Latrobe, Pa., is the most wear-resistant steel known to man. Products manufactured from this steel include plow and pug mill tips for use in mixers and pug mills.

ranging from minus 70 degrees F. to plus 250 degrees F.

Advantages claimed for use of this material are: uniform adhesive thickness between the core and facing material, controlled adhesive confinement to the immediate bonding area, and simple application procedures which result in clean bonding operations. These films have been used in the fabrication of bonded primary air frames in aircraft and missile honeycomb sandwich structures.

Black Finishes for Zinc Plates and Die-Castings

A green-colored solution which produces a deep lustrous black finish on either plain zinc die-castings or zinc-plated parts in about 10 to 120 seconds of immersion time, has been announced by Wagner Brothers Inc., 400 Midland, Detroit, Mich. The liquid, called "Nero-Zinc," is applied to the parts to be treated in the form of a bath, in which one part of the solution is added to three parts water which has been heated to a temperature between 110 to 150 degrees F. Parts so treated are ideal for camera or instrument components where non-reflecting surfaces are required. This finish is also used for color identification purposes.

Cork Cushions Provide Vibration and Shock Control

The Korfund Co., Inc., 48-39M 32nd Place, Long Island City 1, N. Y., recommends the use of "Vibracork" for controlling vibration, shock, and noise on machinery. The material is available in two density designations: "standard" which has a load capacity of 1500 to 4500 pounds per square foot, and "heavy" which has a load capacity of 4500 to 8500 pounds per square foot. It is available in thicknesses of 2 and 3 inches for both densities, with an additional thickness of 1 inch in the heavy density designation. Vibracork resists oil, water, and acids normally encountered in industrial applications and may be used continuously at a temperature not exceeding 180 degrees F.

Coloring and Burnishing Compound for Barrel-Finishing Operations

An all-purpose coloring and burnishing compound that imparts a high gloss and a virgin-metal color to any metal or alloy in a run of forty-five minutes to one hour has been made available by the Lord Chemical Corporation, 2068 S. Queen St., York, Pa. The material, called "Lorco Lustre-All," can be effectively used on all metals or alloys and leaves no film of any kind. It will work equally well with other coloring or burnishing media.

Teflon O- and V-Ring Seals withstand Extreme Temperatures and Pressures

Machine seals made of "TSI" Teflon rod stock have been made available by Tri-Point Plastics, Inc., 175 I. U. Willets Road, Albertson, Long Island, N. Y. These O- and V-ring seals have square, round, or oval cross-sections and are presently limited to a maximum size of 15/16 inch outside diameter and 3/4 inch inside diameter. Some are as small as 3/32 inch outside diameter. The seals, which have been subjected to pressures up to 30,000 pounds per square inch, temperatures of from minus 200 degrees F. to plus 425 degrees F., and corrosives such as fuming nitric acid without failure, are used in the chemical process, aircraft, and electronics industries.

Cold Solvent Stripper for Epoxy Finishes

An economical cold solvent stripper for epoxy finishes as well as epons, vinyls, urea-formaldehyde resins, modified alkyds, and other general industrial finishes has been developed by Octagon Process, Inc., 30 Bank St., Staten Island 1, N. Y. This nonflammable, cold solvent stripper, known as "Octastrip 444," is safe to use on all metals and is ideal for tank immersion operations where fast production-line stripping is required. The stripper acts in fifteen to sixty seconds and parts must be water rinsed to obtain clean metal surfaces after treatment.

A modified formulation called "Octastrip 444-S" is also available for parts that cannot be immersed. These parts are treated by brush.

Adhesive for Bonding Plastic and Rubber to Metal

"Rubbaweld," which is used for bonding rubber, plastic, and fabric to metal, has been made available by Rubba, Inc., 1015 E. 173rd St., New York 60, N. Y. It provides a flexible shock-resistant bond that is not affected by most oils, acids, or alkalies. The material is self-curing and requires neither heat, a catalyst, nor an accelerator. It is a one-part adhesive which can be applied by brush or coating machine.

Metal Layout Fluid Produces Film with Relatively Little Glare

Beechem Laboratories, 1102 W. State St., St. Johns, Mich., have developed a metal layout fluid that produces a film with relatively little glare. It

dries rapidly, is tough, and adheres to all metals without the need of roughening the surface. Called "Beechem Layout Fluid," this compound is resistant to water, oils, and trichlorethylene fumes and is not affected by humidity. The fluid has a permanent shelf life and does not form a gritty precipitate upon aging. It can be removed with alcohol.

Acrylic Spray which Simplifies Molding Pattern Care

In foundries where wooden patterns are normally covered with shellac to give them a smooth surface, a sprayed-on coating may now be used which permits easy drawing from the sand mold. The product, known as "Krylon" crystal-clear acrylic spray, is made by Krylon, Inc., 18 W. Airy St., Norristown, Pa. It is sprayed on patterns in a thin coating to give a resilient surface that is impervious to the action of oils and other substances in the sand.

Vinyl-Base Organosol Coating for Metals Resembles Leather

A rich, grained leather appearance that can be obtained by coating metal surfaces with "M & T Armorhide" has been announced by Metal & Thermit Corporation, Rahway, N. J. This coating, which is sprayed over a special primer and then followed by a texture-agent spray before being cured at 350 degrees F. for approximately fifteen minutes, has resistance to moisture, perspiration, acid, alkalies, and other corrosives. It absorbs shock without chipping or cracking, has a dielectric strength of 400 to 500 volts per mil, and is available in a wide selection of colors.

Gear Lubricant is Applied Like Oil and Adheres Like Grease

A gear lubricant which can be poured out of a can like oil, but adheres to the gear like grease, has been introduced by Charles Pettinos, Inc., 1 E. 42nd St., New York 17, N. Y. Known as "Graphilm Industrial Lubricant No. 702," it was developed primarily for open gears, but can also be used on roller chains and other applications. Only natural flake graphite whose purity has been chemically raised to over 99 per cent is used. The average particle size of the graphite used is under 2 microns (1 micron is equal to 0.001 millimeter) and it will not settle out of the oil or cake or harden. Besides the oil carrier, a specially developed additive enables the material to adhere to the metal, thereby eliminating the loss of lubricant through dripping.

Surrounding this Buick automobile are only some of the seventy-four aluminum parts, totaling 116 1/2 pounds, that are used in producing the 1958 model. The average 1958 automobile contains 52.4 pounds of aluminum, which is an increase of 29 per cent over last year's models.

Economical Small-Lot Machining of Large Parts

Heavy steel weldments and castings for road-building equipment are being processed on special machines of unique design which feature multiple tooling mounted on hydraulically operated turrets. Floor space savings of up to 80 per cent and reductions in capital equipment costs of 50 per cent are possible with these multiple-purpose machines.

A MANUFACTURER of road-building equipment has solved the problem of economically machining small lots of heavy steel weldments and castings by providing special multiple-purpose machines of ingenious design. Four of the six special machines, all built by the W. F. & John Barnes Co., Rockford, Ill., feature multiple tooling mounted on hydraulically operated turrets. Spindles on the various heads only rotate when the heads are indexed into machining positions opposite the work-holding fixture. This is accomplished by a unique arrangement of dogs, selector switches, and contactors, which eliminates the need for numerous slip rings.

By combining many operations in one machine, important savings in both machining and work-handling time are obtained. Economy has also been attained by designing several of the machines to process more than one part. These features also provide substantial savings in floor space requirements. It has been estimated that the four turret type machines effect a reduction in equipment costs of up to 50 per cent and a decrease in floor space of as much as 80 per cent. While these machines were built specifically for processing road-building equipment components, the same design principles can be economically adapted to similar low-production work for either larger or smaller work-pieces.

On one of the special turret type machines, Fig. 1, a six-station rotary table is provided for the tooling, and the work-holding fixture is mounted on a shuttle saddle. This machine is used to process three welded steel cases (a right- and left-hand case of one size, and one larger case) and the top cover plates for each case. Three interchangeable work-holding fixtures are provided: one for the right- and left-hand cases, the second for the other case, and the third for all three cover plates. Only three of the six tooling heads are used for each case or cover. Each head has from 27 to 35 spindles, and tools are provided to drill, ream, chamfer, counterbore, tap, and mill the parts. Loading of the work-piece requires approximately 3 minutes, and unloading, 2 minutes. At 100 per cent efficiency, 6.55 cases or 9.05 covers can be completed per hour.

The cast-iron rotary table base is provided with an extra finished flange (120 degrees from the flange to which the work saddle base is attached) for the possible future addition of another work base, if production requirements make it necessary. Hardened and ground steel ways are provided for the shuttle saddle on which the work-holding fixture is mounted. The fixture saddle is arranged with a Barnes floor-mounted hydraulic unit to furnish three feed rates, and switches are provided to start the feeds at the proper positions.

The 96-inch diameter rotary table weighs about 40 tons when equipped with the heads, motors, spindles, and bushing plates. A power-operated

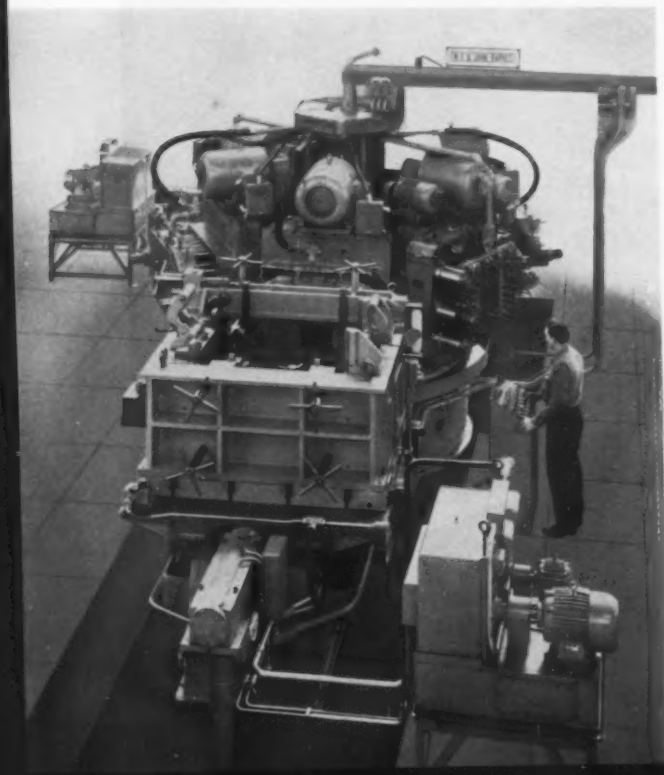


Fig. 1. Turret type machine has multiple tooling mounted on six-station rotary table and work held in a shuttle fixture.

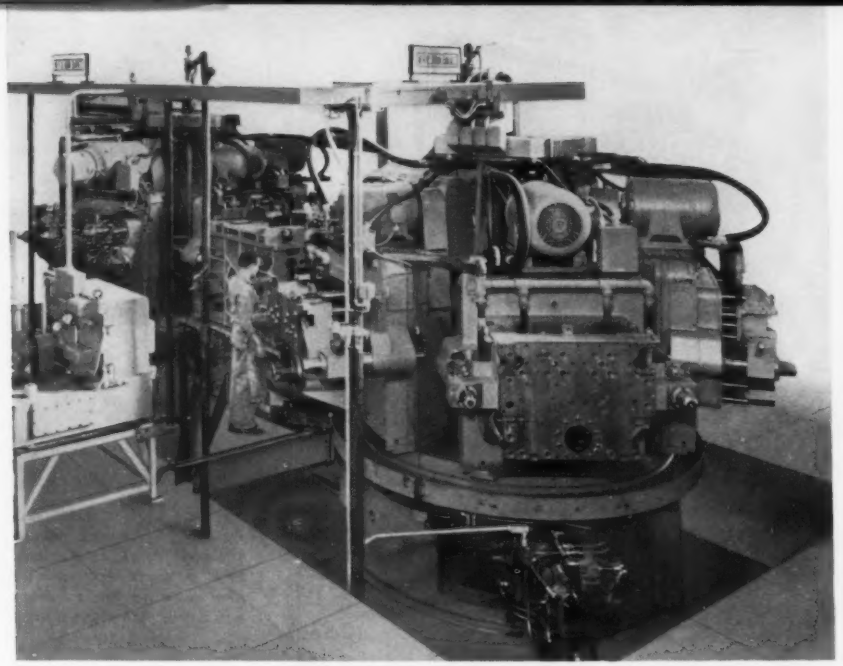


Fig. 2. (Left) Two five-station rotary tables, one at each end of a shuttle work-holding fixture, are employed on this special machine.

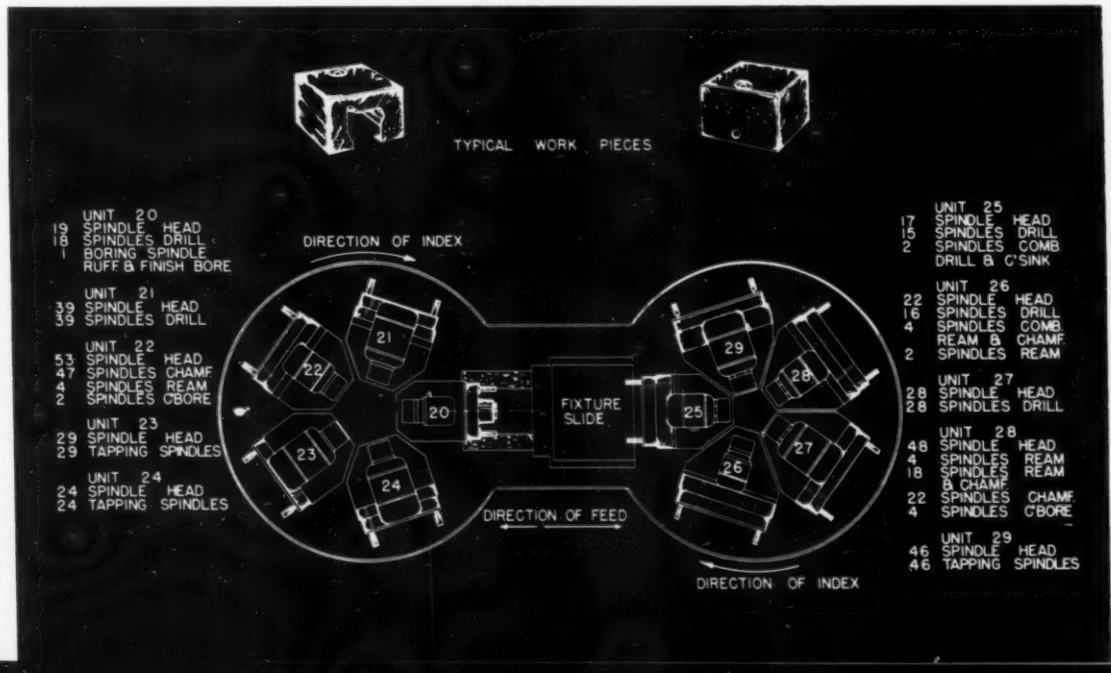
Fig. 3. (Below) Schematic drawing of the dumbbell-shaped machine illustrated in Fig. 2. Operations performed by the multiple-spindle heads are listed.

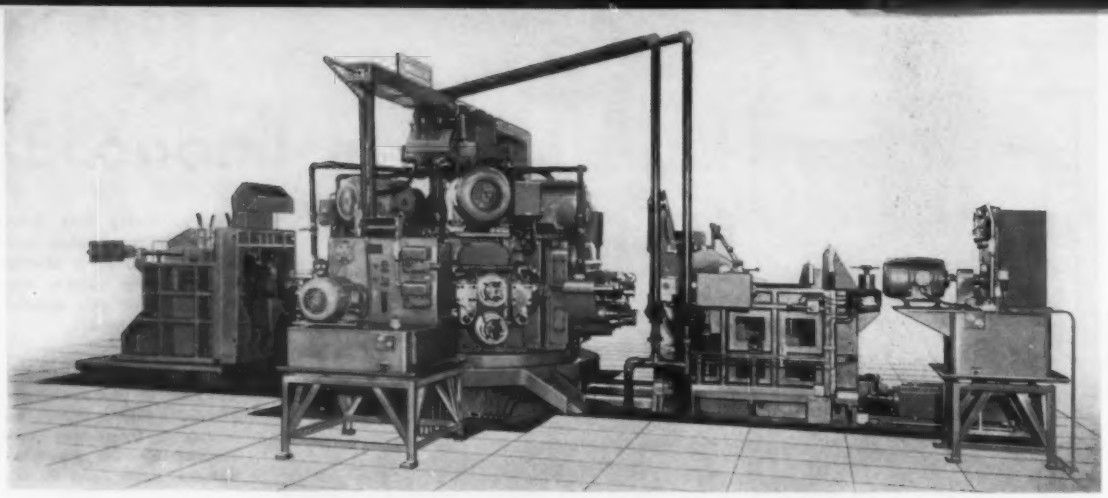
locating pin is provided for indexing the table. Because the machine is designed with stationary heads (the tapping heads are equipped with individual lead-screw spindles), only two hydraulic units are required. One hydraulic unit is used to index the rotary table, and the other, as previously mentioned, to feed the work.

On another of the special turret type machines, Fig. 2, two five-station rotary tables are provided (one at each end), and the shuttle work-holding fixture is mounted on ways between the two tables. The same three cases processed on the machine previously described are also handled on this machine. Operations performed by the various multiple-spindle heads are listed on the schematic drawing of the machine, Fig. 3. Loading and unloading times are about the same, and 2.90 cases can be completed per hour at 100 per cent efficiency.

The shuttle type fixture is equipped with locating blocks and clamps for the special work-holding pallets used on this machine. Each case is located in a pallet by means of four retractable dowels and three milled spots, and is clamped manually before loading the pallet into the shuttle fixture. Three hydraulic units are employed on this machine, one for indexing each of the two rotary tables, and the third for feeding the work.

Another variation of the same basic turret design has been used for a third special machine, Fig. 4. Here, a centrally located six-station rotary table is used, and two shuttle type work-holding fixtures are provided, one at each end. This machine also handles the same three cases, as well as





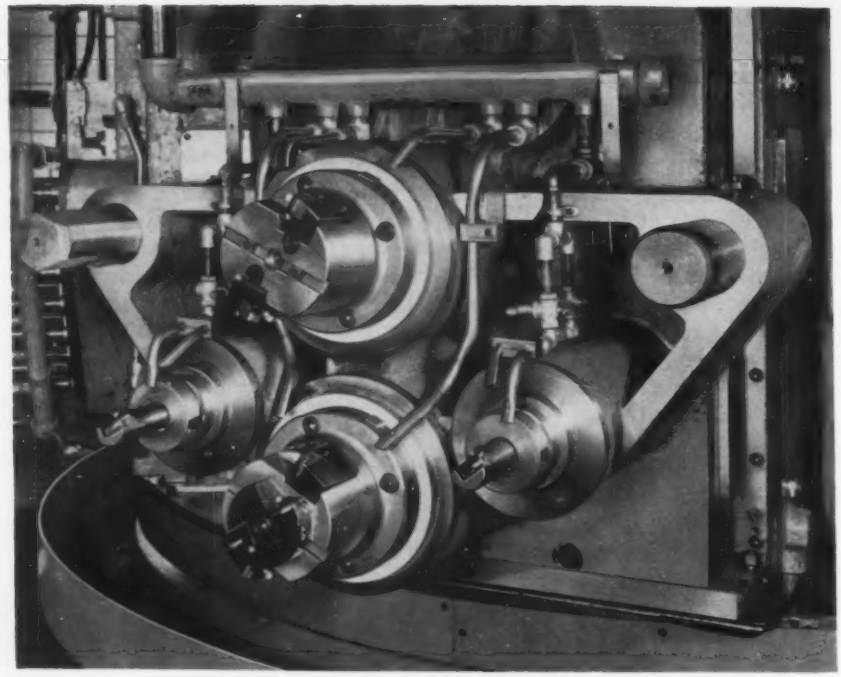


Fig. 4. (Above) Three welded steel cases and two gear covers can be processed on this machine which has two shuttle type work fixtures.

Fig. 5. Throw-away type carbide tools are used on this four-spindle boring head—one of the six heads on the special machine seen in Fig. 4.

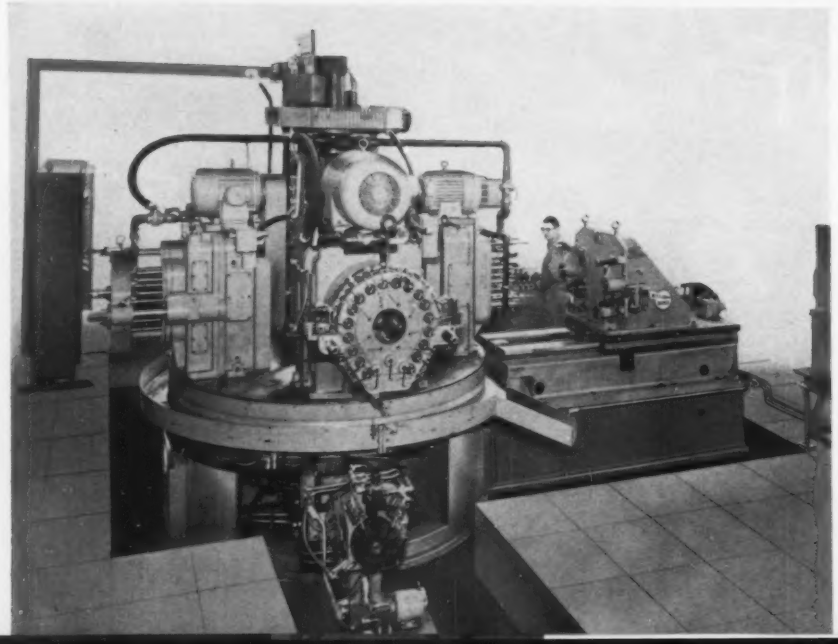


Fig. 6. A four-station rotary table and one shuttle type work-holding fixture are employed on this machine to process two different gear covers for road-building equipment.

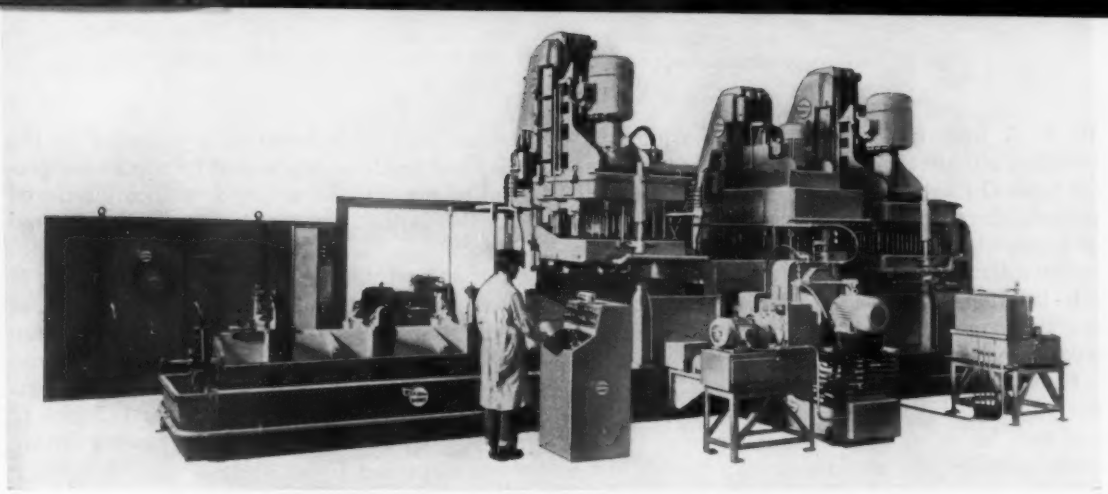


Fig. 7. Five-station, shuttle type machine has three vertical and two horizontal heads for drilling various holes in four roller frames.

two different gear covers. Operations performed include drilling, boring, chamfering, and tapping, with each head carrying from four to twenty-one spindles. A close-up view of one of the four-spindle boring heads, equipped with throw-away type carbide tooling, is shown in Fig. 5. A surface finish of 50 micro-inches must be produced on the main bore surfaces, and a tolerance of 0.001 inch is maintained on diameters and center spacings.

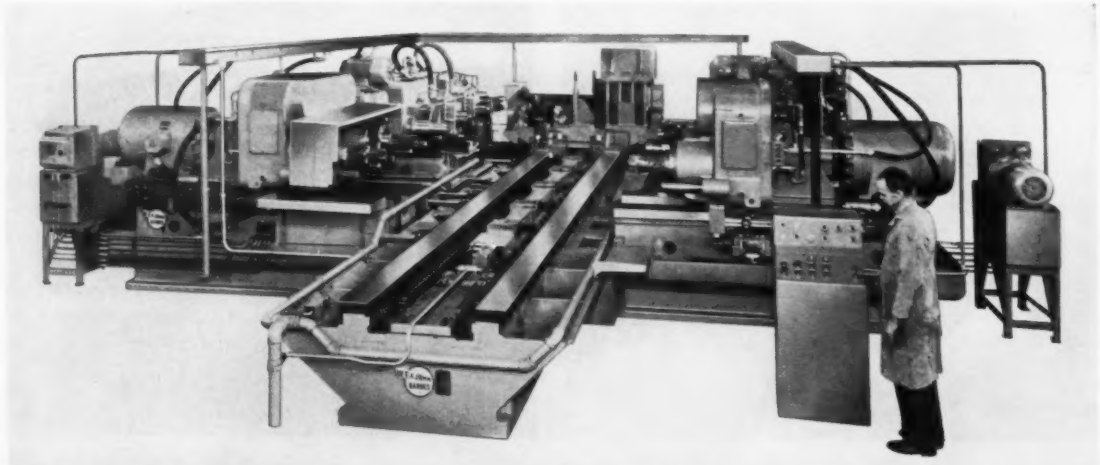
One saddle carries a fixture for holding the two special work-holding pallets used on the previous machine. The opposite saddle has a fixture for holding the two gear covers, which are located from the contours of the castings. Pallets holding the cases are transferred from the previous machine to this one without unclamping. Cases are completed at the rate of 4.73 per hour, and gear covers, at 5 per hour (at 100 per cent efficiency).

The fourth special turret type machine, Fig. 6, has a four-station rotary table and one shuttle type work-holding fixture for processing the two different gear covers. One head on the table has a single spindle that is tooled to chamfer and face one of the gear cover surfaces. Another has twenty-five spindles that each carry a drill. A third head has twenty-nine spindles—eleven of which are used for chamfering and eighteen for spot-facing. The fourth one is equipped with fourteen tapping spindles. Loading and unloading of the work each require 0.90 minute, and both gear cover parts are completed at the rate of 5.9 per hour, with 100 per cent efficiency.

As in the previous machines, an extra finished pad has been provided on the cast-iron rotary table base for the possible future addition of another fixture saddle base. The fixture saddle is equipped with a Barnes hydraulic unit that provides two feed rates forward and one in reverse. The cycle is arranged to traverse the saddle forward and hold it in this position during tapping, which is performed with individual lead-screw spindles. For the generating type facing operation, the saddle traverses forward and feeds to a positive stop. After this operation, the saddle returns, and the positive stop can be manually adjusted to a second position to allow a second cut with a feed-out tool.

The other two special machines built by

Fig. 8. Cast-steel frame parts for road-building equipment are drilled, bored, faced, chamfered, and tapped on this seven-station shuttle type machine.



W. F. & John Barnes for manufacturing road-building equipment are of in-line, shuttle transfer type. On both machines, the fixture saddle is power-indexed along horizontal ways by means of a geared-head, clutch-brake motor that drives heavy roller chains looped over sprockets. Accurate location of the saddle at each working station is accomplished with hydraulically operated, wedge type index bars.

One of the shuttle type machines, Fig. 7, has five stations, and is equipped with three vertical and two horizontal heads (having from two to thirty spindles) for drilling various holes in four different welded steel roller frames. Loading and unloading of the frames, weighing 2700 pounds, each require 5.50 minutes, and 2.81 parts are completed per hour at 100 per cent efficiency.

The universal work-holding fixture is built as a part of the saddle, and is provided with various bases and surfaces for mounting locating blocks and clamp brackets to accommodate the different length frames. Work-pieces are located from half-round holes in the parts and the previously milled side surfaces. Locating and clamping are both manual. Tool guide-bushings are carried by the individual machine heads, and interlocks are provided to prevent the saddle from being indexed until the bushing plates are in their retracted positions.

The second shuttle transfer machine, Fig. 8, has seven stations and six horizontal heads for drilling, boring, facing, chamfering, and tapping two different cast-steel frame parts. Loading and unloading each require 5 minutes, and 3.25 parts are completed per hour. As much as 1/2 inch of stock is removed from parts of the casting during boring, requiring 75 hp.

Electrical controls on all machines are built according to JIC standards, and each machine is equipped with a Barnes Electro-Graphic Detector—a wired-in checking system for quickly and accurately locating malfunctioning electrical components and failures in the electrical control setup. The individual hydraulic units also conform to JIC standards. Bases of the machines are arranged so that the coolant and chips flow into a chip conveyor, and the coolant enters tanks in the floor.

Machine Tool Distributors Meet on Note of Optimism

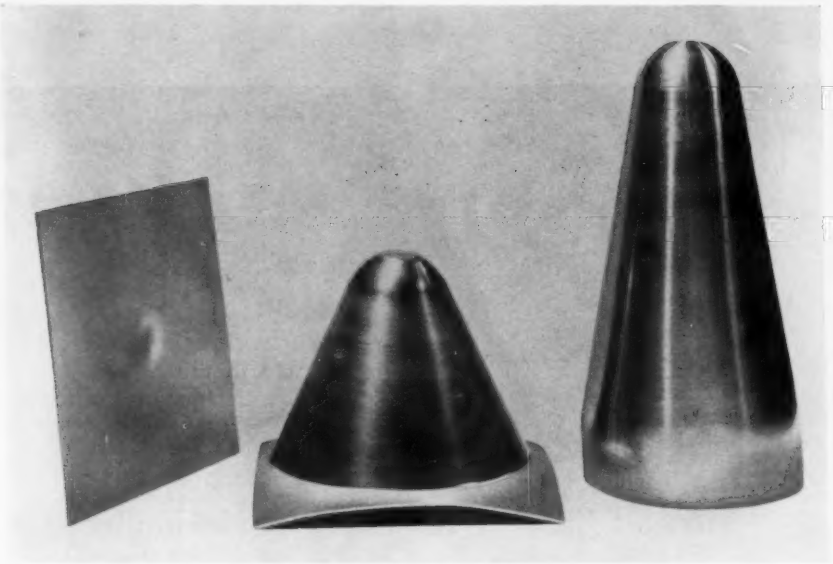
CONFIDENCE in the ability of the machine tool industry to snap back from the low business level of the past few months was voiced at the Thirty-Fourth Spring Meeting of the American Machine Tool Distributors' Association, at the Hotel Roosevelt, New Orleans, La., March 10 and 11. Frank H. Habicht, Chicago, Ill., Association president, predicted that "we can increase the volume of new orders for 1958 over 1957—in spite of our slow start. While attending regional meetings," he continued, "I talked with distributors and customers in many different parts of the country. Everywhere I got the feeling of cautious optimism."

The greatest potential for new machine tool business this year is the dire need for all manufacturers to beat the price-cost profit squeeze and obtain higher levels of output per man-hour, Habicht claimed. He pointed out that what this industry and all America needed was renewed enthusiasm—comparable to that experienced by the industry in the fourth quarter of 1955 after the Machine Tool Show in September of that year.

Stressing sound management as a key to more sales, the AMTDA conducted a series of forums designed to help solve the complex problems of machine tool distribution. Major subject areas covered were: sales and service, administrative management, manufacturers relations, and problems of multiple-line houses. I. B. Rabel, Seattle, Wash., chairman of the AMTDA committee on management, noted that through these forums the industry has uncovered a series of problems which will be given further careful study by the Association.

An association survey of machine tool financing by distributors, reported by William L. Walker, showed that in the last ten years the percentage of machine tool sales made on conditional sales contracts has increase substantially. In 1948, 43 per cent of the distributors sold no machines on time, but only 23 per cent report no deferred payment sales last year. For the East, there is not only a greater proportion of distributors selling on time, but the percentage of their sales has increased substantially. For some Midwest regions, the percentage of time sales has actually dropped. But the Missouri Valley, Inter-mountain, Southwest, and West Coast areas all show a consistent increase in the number of machine tools sold on conditional sales contracts.

"THIS MACHINE WAS MADE IN AMERICA AND SOLD BY A MEMBER OF THE AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION" is the message on a nameplate the AMTDA is making available to its members to attach to new equipment they sell. The nameplate is part of the AMTDA effort to gain public recognition of the close relationship between the American-made machine tool and the American standard of living.



Stainless-Steel Nose Leads the Explorer

THE RECENT LAUNCHING of the first United States satellite, the Explorer, has partially lifted the veil of secrecy surrounding some of the manufacturing processes used in its fabrication. One such process, that of shaping the 13-ounce stainless-steel nose cone of the instrument package, is accomplished in an interesting series of steps.

Three basic steps, centering around Floturning operations, were used to produce the nose cone at the Lodge & Shipley plant, Cincinnati, Ohio. A 0.094-inch thick, square blank of Type 430 stainless steel is dimpled in the center (left, heading illustration) to form a mandrel-locating surface. The blank then undergoes the first Floturn operation, Fig. 1, being rolled back along a 25-degree mandrel to the shape shown in the center of the heading illustration.

An initial trimming removes the waste metal and a spinning operation forms a parallel-sided, 6.170- to 6.190-inch diameter mouth opening. Heat-treatment to relieve built-up stresses precedes the final forming step. The preformed cone is rolled back to its finished shape along a new mandrel, as shown in Fig. 2.

The completed nose cone (right, heading illustration) measures 12.117 inches in length and has a major diameter of 6.158 to 6.168 inches. Metal thickness ranges from 0.013 to 0.017 inch along the conical walls, to 0.094 inch at the center of the blunt nose.

Fig. 1. Square stainless-steel blank, 0.094-inch thick, is about to be flowed back along a 25-degree mandrel during the first forming operation. A dimple in the blank serves as a locating surface for the mandrel.

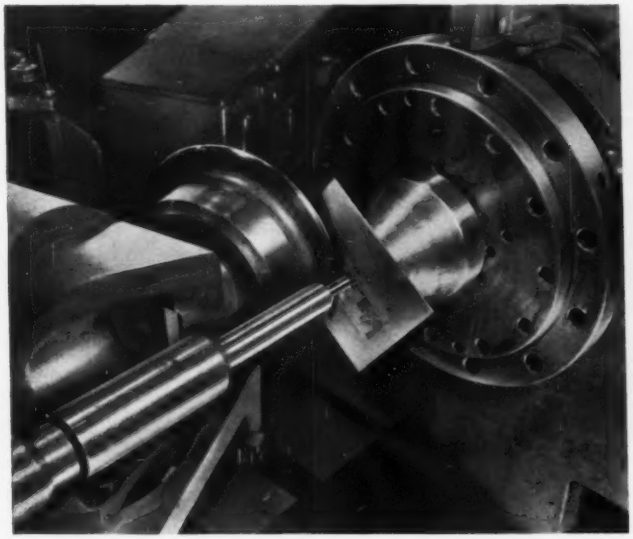
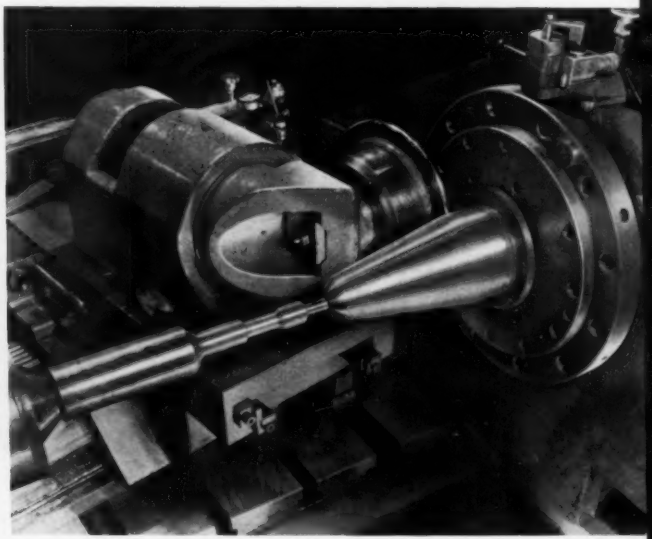
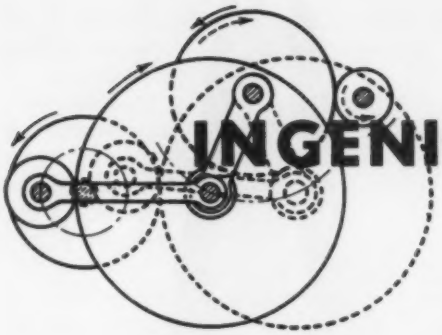


Fig. 2. During a final forming operation, immediately after stress relieving, the nose cone is shown 85 per cent completed. Conical wall thickness is approximately 0.015 inch; wall thickness at the nose remains 0.094 inch.





INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

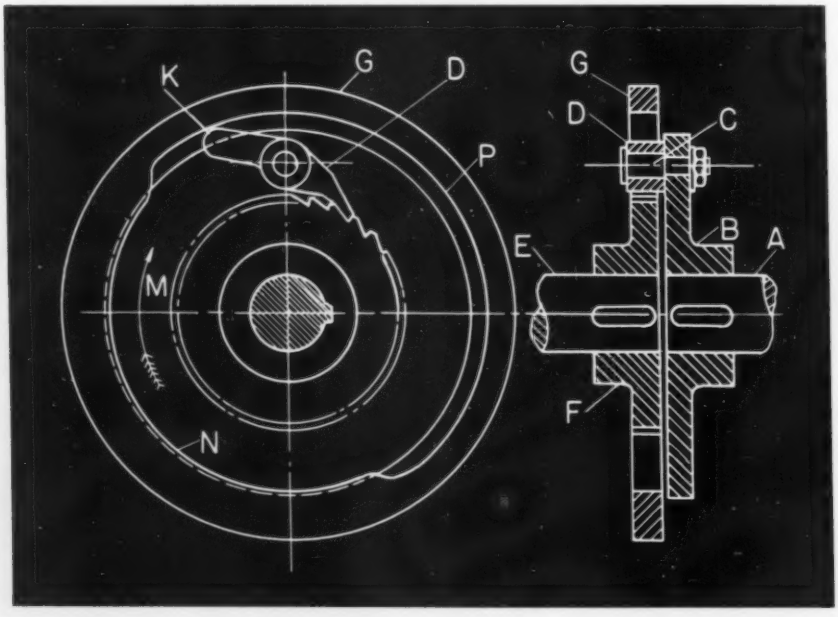
Cam and Ratchet Intermittent Mechanism

OSCAR O. NAGELIS, Santiago, Chile

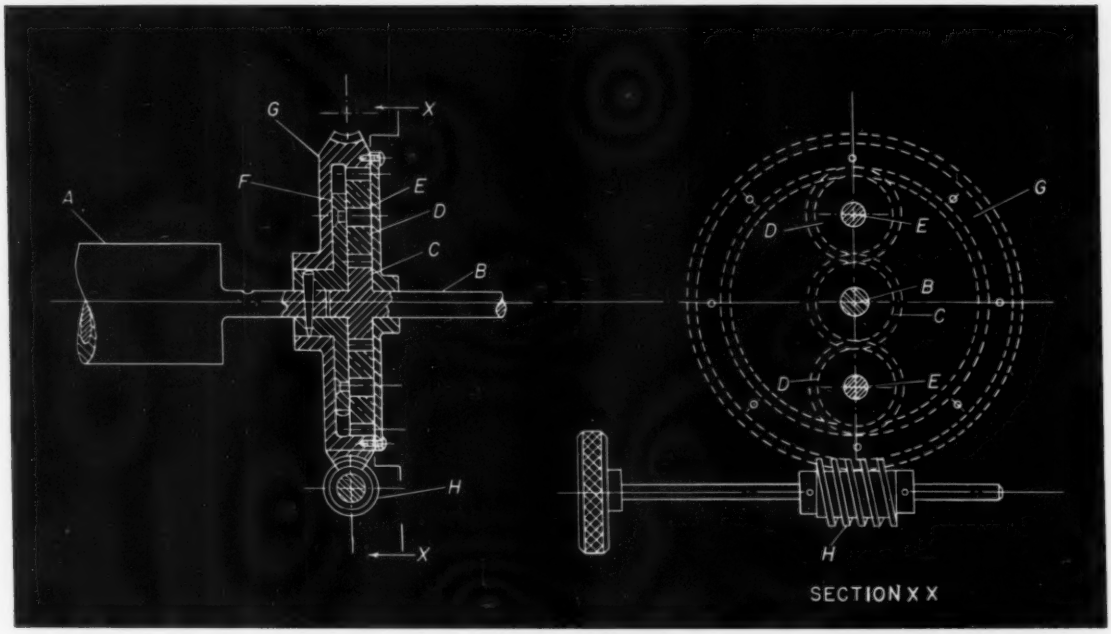
A mechanism that employs a cam, ratchet, and pawl for converting constant rotation into intermittent rotary motion is shown in the accompanying illustration. Drive-shaft *A* of this mechanism revolves constantly. Keyed to it is disc *B* which carries pin *C* that is the pivot for pawl *D*. On the driven shaft *E* there is keyed ratchet wheel *F*. The inner end of the pawl engages the ratchet teeth while the outer rides around a cam path cut into disc *G*.

As pivot-pin *C* is carried around disc *G* by the rotation of the drive-shaft in the direction indicated by the arrow at *M*, shaft *E* is turned by pawl *D* during the period when end *K* of the pawl is riding along the high section of the cam path. This high section is indicated by letter *P*. A spring, not shown, exerts sufficient pressure to hold the cam tooth in engagement with one of the teeth on the ratchet during this period of pawl movement.

When end *K* of the pawl reaches the low portion of the cam indicated by letter *N*, the pawl is swung on its pivot and its tooth is disengaged from the ratchet. The driven shaft *E* then remains stationary until end *K* of the pawl again rides on the high section of the cam and the pawl tooth has once more been swung into engagement with a cam tooth.



Mechanism that employs a cam, ratchet, and pawl for converting constant rotation into intermittent rotary motion.



When the ring gear (G) is rotated by worm (H), the timing of driven shaft (A) changes with respect to the driving shaft (B).

Timing of Driven Shaft Changed While Running

RALPH T. STEWART, Winston-Salem, N. C.

A power train through sun gears which rotate within a stationary, but adjustable ring gear permits the timing of a driven shaft to be changed while it is running. The arrangement is used in positioning revenue stamps correctly in a tobacco-packaging machine.

Ordinarily, driven shaft *A* and driving shaft *B* revolve in unison. The transmission is as follows: Pinion *C*, integral with the constantly revolving driving shaft *B*, meshes with two sun gears *D*. These sun gears are the same size as the pinion. They are free on studs *E* fixed in diametrically opposite points in disc *F*. Near the center, the disc forms a hub which is pinned to driven shaft *A*. Both sun gears mesh with stationary ring *G*. Thus, as shaft *B* revolves, the sun gears revolve on their studs, and in addition they rotate within the ring gear, causing the disc to turn shaft *A*.

For changing the timing of shaft *A* with respect to shaft *B*, the outside of the ring gear is designed as a worm-wheel. By means of worm *H*, the ring gear can be rotated in either direction through 360 degrees. This changes the angular displacement of the disc relative to the pinion, and advances (or retards) the driven shaft the required amount. No stoppage of the mechanism is made, and since the worm is self-locking, it will preserve the timing, once set.

In this particular application, it was necessary to obtain a 3 to 1 reduction in the transmission. The pinion and sun gears have 20 teeth each, and the ring gear has 60 teeth.

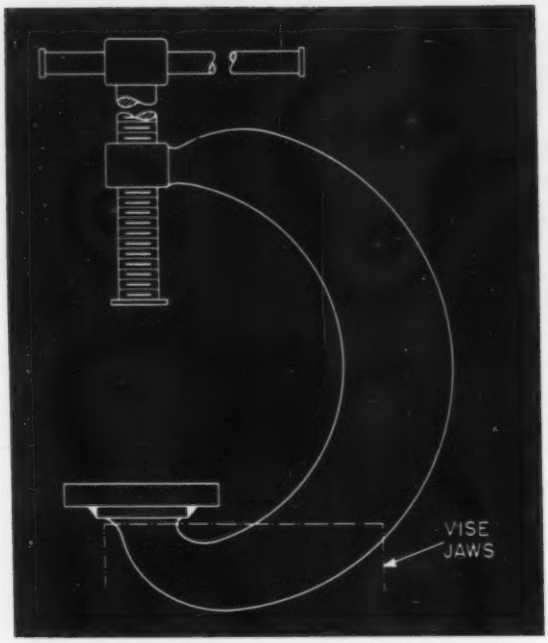
° ° °

Suitability of Zirconium for Commercial Applications

One of the developments of the last few years has been the emergence of zirconium from the category of a laboratory curiosity to a metal of increasing commercial significance.

Characteristics of pure zirconium, according to *Advanced Materials Technology*, published by the Carborundum Company, are its extraordinary resistance to corrosion and its strength and transparency to thermal neutrons. This combination of properties makes it particularly suitable as a cladding material for uranium fuel elements and as a structural metal for nuclear reactors. As a result, until recently, practically all available production has been earmarked for application in the atomic energy field.

SHOP KINKS



When adapted with a pressure plate and supported vertically, a C-clamp becomes a miniature arbor press.

Miniature Arbor Press Made from C-Clamp

ROBERT HILL, Columbus, Ohio

A miniature arbor press ideal for straightening out bends and dents in sheet metal can be constructed from a large C-clamp. For a pressure plate, a piece of flat stock is brazed to the stationary jaw. A knurled rod serves as a handle to turn the screw. For adequate leverage the rod should be about 12 inches long.

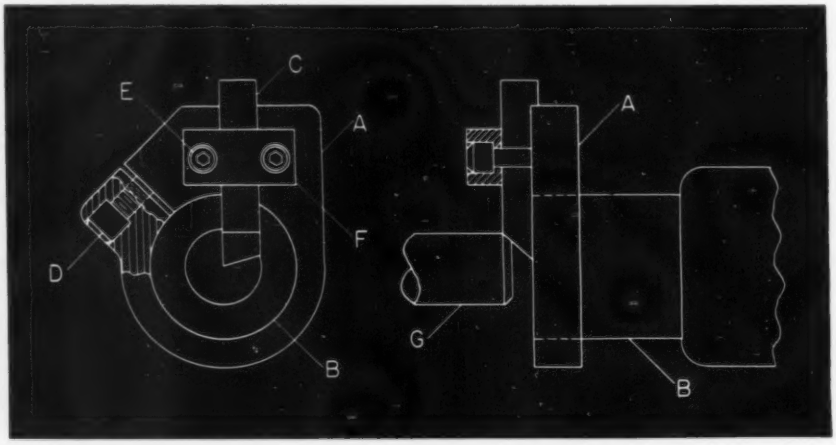
The clamp can be gripped in a vise, or if a more permanent setup is preferred, two strips of flat stock can be welded to each side of the clamp and, in turn, welded to a steel table.

Tailstock Tool-Holder for Chamfering Operations

JOSE C. SOBKOWIAK, Jackson, Mich.

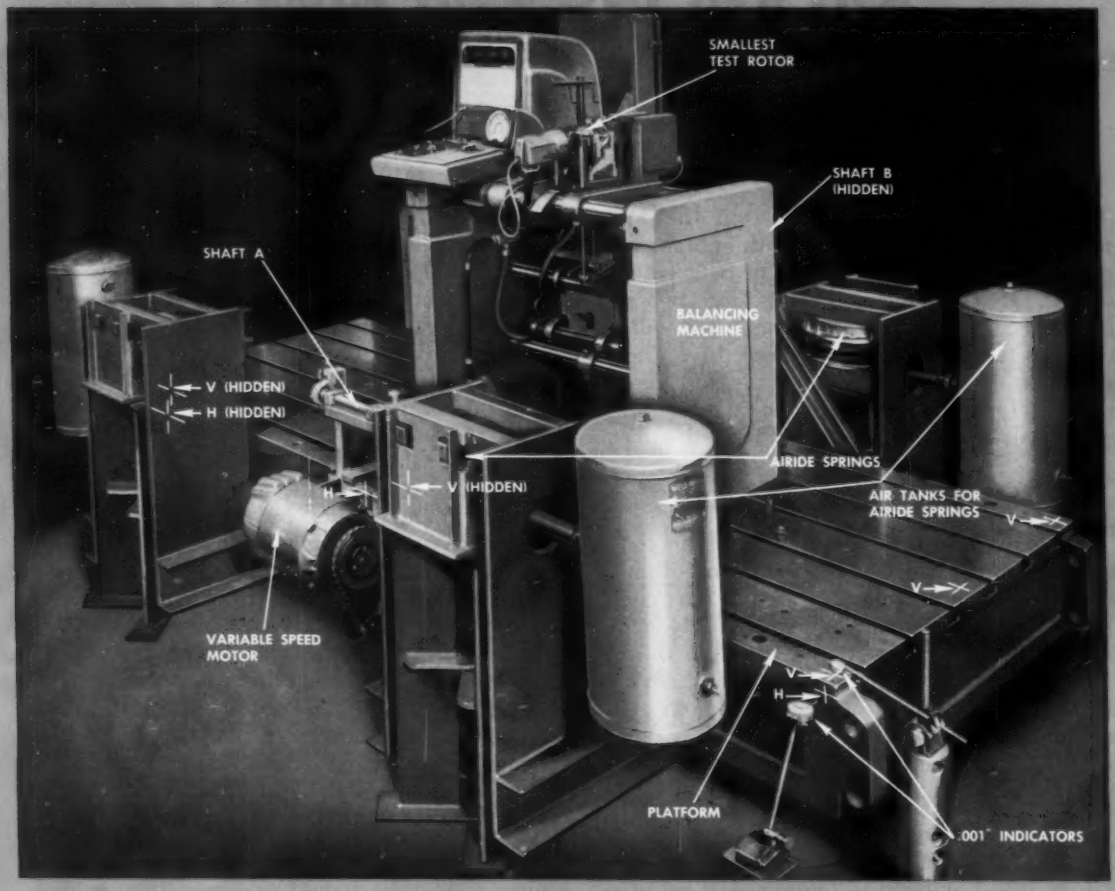
A chamfering attachment that can be clamped over the spindle of the lathe tailstock is here illustrated. The use of this tool-holder releases the toolpost on the lathe compound for other operations and is especially convenient for the production of threaded pieces.

Tool clamp *A* is bored to fit the tailstock spindle *B*, and a keyway is milled in part *A* to receive the tool *C*. This keyway is offset, permitting the cutting edge of the tool to be directly in line with the axis of the lathe. A slot is milled in the clamp, and a socket head cap-screw *D* is provided to tighten the clamp around the tailstock spindle. Two screws *E* and strap *F* allow adjustment of the tool to different sizes of work. The tool is ground to produce a 45-degree chamfer on the work-piece *G*. In operation, a cut is taken by feeding the tool to the work by the handwheel on the tailstock.



Tool-holder that is attached to the lathe tailstock for chamfering operations.

MACHINERY'S *Reference Section*



Performance Tests for BALANCING MACHINES

W. I. SENGER
Vice-President of Balancing
Gisholt Machine Co.
Madison, Wis.

Part 2

April 1958

Performance Tests for BALANCING MACHINES

W. I. SENGER, Vice-President of Balancing
Gisholt Machine Co., Madison, Wis.

THE REFERENCE SECTION in the March number of MACHINERY dealt with equipment required for performance testing of balancing machines. It recommended tests for two-plane balancers. This concluding installment will discuss the testing of the work-piece drive, the desirability of separately indicating and directly reading force and moment unbalance, single-plane balancing machines, and related subjects.

Testing the Work-Piece Drive

The drive for the balancing machine should have negligible effect on the indication of unbalance. To accomplish this, the weight (in ounces) of that part of the balancing-machine drive which is supported by the work-piece (while the machine is indicating unbalance) multiplied by 0.0002 should be less than the maximum allowable unbalance U in ounce-inches. If any part of the driving device is attached to the work-piece and continually maintains a definite angular position with respect to the work-piece while unbalance indications are made, means should be provided in the driving device for applying unbalance corrections which are effective in two transverse planes. The work-piece should be driven by means of a coupling attached to one end of the work, a belt over a diameter of the part, or a pulley attached to the work-piece.

With the balancing machine at its most sensitive position, the smallest test rotor should be balanced until there is less than one-half the allowable residual unbalance in each plane. All parts of the balancing machine drive which are supported by the rotor should be removed from the rotor. Then, the test rotor should be rotated exactly 180 degrees with respect to the drive member, and the drive member again attached. Run the work-piece in the balancing machine and observe the unbalance indications. In each plane, the unbalance indication should be less than one and one-half times the allowable residual unbalance.

The rotor should be balanced again, until there is less than one-half the allowable residual unbalance in each plane. Introduce a two-times-U unbalance in the left plane at zero degree, and a two-times-U unbalance in the right plane at 180 degrees. Correct for these unbalance effects by changing the condition of balance of the coupling. Means should be available in the coupling to reduce the unbalance indications to one-half the allowable residual unbalance in each plane.

The weight in ounces of that part of the balancing machine drive which is supported by the test rotor should be determined. If the drive is by belt, only that portion of the belt which is actually supported by the rotor should be weighed. Do not include the force imposed by belt-tension devices. However, the weight of any pulleys or devices attached to the test rotor should be included if the belt does not run over the body of the test rotor.

If the drive is from one end of the rotor, determine the weight (at the point of attachment to the test rotor) of all parts removed to permit turning the rotor 180 degrees. The product of the weight of the drive (in ounces) times 0.0002 should be less than the maximum allowable un-

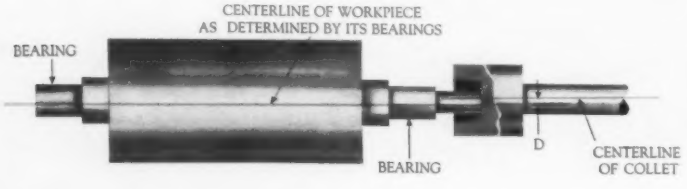


Fig. 10. Center line of work-driving collet may be offset from axis of work-piece because of bent shaft, eccentric surfaces, manufacturing tolerances, or collet wear.

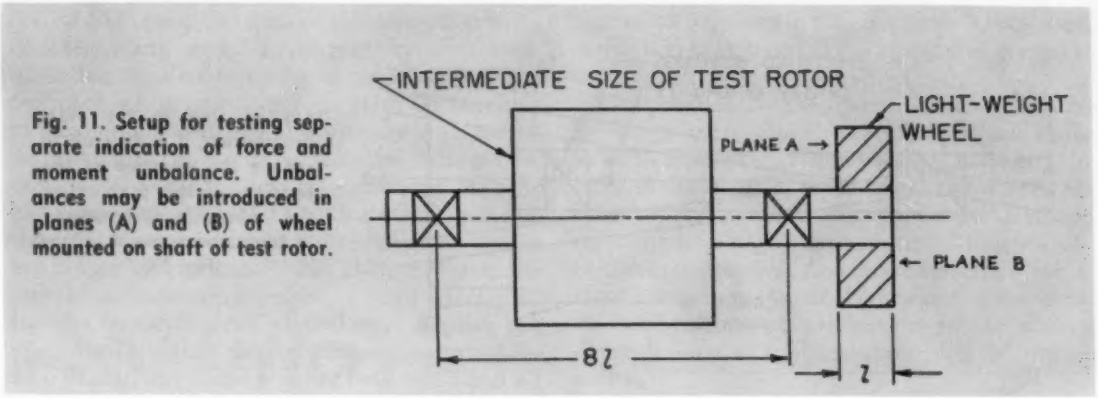


Fig. 11. Setup for testing separate indication of force and moment unbalance. Unbalances may be introduced in planes (A) and (B) of wheel mounted on shaft of test rotor.

balance *U*. These tests should be repeated with the largest size of test rotor.

The device used for driving work-pieces in a balancing machine often introduces unwanted unbalance effects. Any driving device which continually maintains its angular position with respect to the work-piece becomes a part of the work so far as the unbalance indicator on the balancing machine is concerned. There are two methods that are generally used to drive the work: an end drive by means of a collet and adapter attached to the end of the work, or a belt drive by means of a belt driving directly over the periphery of the work-piece. Each method has its advantages and limitations.

An end drive can deliver the torque required to drive larger work-pieces, but is generally undesirable for pieces weighing less than 50 pounds. This is because the end drive is relatively heavy and introduces excessive unbalance effects. Also, it is difficult to keep end drives in balance under operating conditions. A belt drive is ideal for lighter work-pieces in that it adds little weight and consequently has little or no effect on the unbalance indications. However, a belt drive is impractical for work-pieces having a large polar moment of inertia, large windage loads at balancing speed, or a large diameter.

It is only at additional cost that any balancing machine manufacturer can supply both types of drives on a given machine. In the interest of economy, only the most practical type of drive should be specified. An end drive device may introduce unbalance for two reasons—the driver itself may be out of balance or the eccentric mounting of the driver may act as an unbalance. To compensate for unbalance in the driver itself (which may change by reason of wear), a compensating means should be available in the driver.

If the drive is in the form of a collet, as shown in Fig. 10, it is quite probable that the axis of the collet will be 0.001 inch from the axis of the rotor (as determined by its bearings). This eccentricity may be due to a bent shaft on the work-piece, eccentricity of the surface gripped by the collet, necessary manufacturing tolerances on this surface, or the impracticability of providing a collet which, during all of its useful life, will continually chuck within 0.001 inch. To insure against the introduction of excessive unbalance effects by reason of this eccentricity and the weight of the driver, the weight of the driver should be limited. This weight, when mounted off the rotational axis of the rotor by 0.001 inch, should introduce less than one-half the allowable residual unbalance.

Force and Moment Unbalance

Balancing machines should be capable of separately indicating the direct amount of force and moment unbalance. This specification should be included if, in present or possible future production, parts are to be balanced in which, (1) the planes of correction in the work-piece are less than one-fifth as far apart as the supporting bearings, (2) the planes of correction do not lie between the supporting bearings, or (3) the planes of correction are toward the same end of the rotor with respect to its center of gravity. Turbine assemblies for jet engines, turbo-superchargers, fans, centrifugal pumps, or flywheels balanced on overhanging arbors are representative parts which require this type of balancing. The four readings of the amount and location of required force and moment unbalance corrections should be taken in one continuous operation without stopping the machine.

The amount-of-unbalance indicator should give readings which are proportional to unbal-

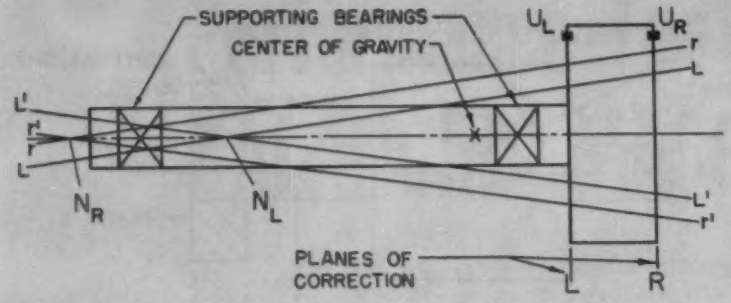


Fig. 12. Due to the mass distribution, it is difficult to reduce the vibration at the bearings of this part unless the unbalance is measured in force and moment values (Fig. 13).

ance. Also, the indicator readings should vary by less than one-quarter of the mean reading of the allowable residual unbalance. The amount-of-unbalance measuring device should have at least 1/8-inch of displacement for the measurement of an allowable residual-force unbalance of .... ounce-inches, and an allowable residual-moment unbalance of .... ounce-inches, in each of two planes which are spaced .... inches apart.

A lightweight wheel in which unbalances may be introduced in planes *A* and *B*, which are one-eighth as far apart as the bearings, should be mounted on the overhanging shaft of the intermediate size test rotor, as seen in Fig. 11. A workpiece may be used to perform these tests if available. The machine should be set up to indicate directly the amount and location of force correction required in plane *A* (nearest the bearings) and the amount and location of equal corrections, spaced 180 degrees apart, in each of the two planes *A* and *B*.

The following test may be made with the machine adjusted to any desired sensitivity. Correct for unbalance in the test rotor until the application of additional correction does not further reduce the unbalance indication. Introduce in plane *A* of the balanced rotor an unbalance force equal to two times *U*. The unbalance indicator should move at least 1/4 inch to measure this "force" unbalance. Introduce in plane *A* of the balanced rotor an unbalance equal to twenty times *U*. The moment unbalance indication should be less than one times *U*. Place in plane *A* of the otherwise balanced rotor a twenty-times-*U* moment unbalance, exactly 180 degrees from a twenty-times-*U* moment unbalance in plane *B*. The force unbalance indication should be less than one times *U*.

In certain types of parts in which the mass distribution is greatly different from that of a conventional rotor, it is difficult to reduce the vibration at the bearings to desirable values. One such part is shown in Fig. 12. The planes of correction are spaced a short distance apart compared with the spacing of the supporting bearings. Both correction planes are toward the same end of the work with respect to the center of gravity, and both are overhanging. If U_L is the only unbalance in the part (while it is rotated in freely supported bearings), the bearing axis of the part will generate cones bounded by the lines *L*-*L* and *L'*-*L'*. Under similar conditions, with only unbalance U_R in the part, the bearing axis will generate cones bounded by the lines *r*-*r* and *r'*-*r'*.

It can be seen that there is little difference in the movement of the supporting bearings for a given unbalance in either the left or the right plane. Therefore, it is difficult with any of the plane-separating devices described to obtain a suitable order of unbalance measuring accuracy in the left and right planes of such parts, as is obtained in a more conventional rotor, such as that shown in Fig. 2 (March, page 157).

This problem can be resolved by measuring unbalance in force and moment values. The effectiveness of this procedure can be understood by reference to Fig. 13. If U_F, in the force correction plane, is the only unbalance in the rotating part, the bearing axis of the freely supported part will generate cones bounded by lines *f*-*f* and *f'*-*f'*. Further, if there are present only the equal unbalances U_M, placed 180 degrees apart in the *L* and *R* planes, the bearing axis of the freely supported rotating body will generate cones bounded by lines *m*-*m* and *m'*-*m'*. It is evident that bearing movements using the force setup differ greatly from those in which the moment setup is employed as the criterion.

Practical Correction Units

The balancing machine should incorporate adjustable means whereby the unbalance measuring device may be calibrated to show the re-

quired correction in terms of the correction units actually being used. In testing for correction units, the smallest test rotor should be placed in the machine. Balance the rotor with the machine at maximum sensitivity and introduce an unbalance equal to twenty times U in the right correction plane. With the test rotor running and the balancing machine set to indicate unbalance in the right plane, calibrate the unbalance measuring device to read exactly 20. Then, calibrate the unbalance measuring device to read exactly 13 for the twenty-times-U unbalance. Repeat this procedure to cause the unbalance measuring device to read any other number between 5 and 20, and for eight other arbitrarily selected numbers between 5 and 20. The entire operation should be repeated with the largest test rotor.

If the balancing machine indicates the amount of unbalance in gram-centimeters, ounce-inches, or some arbitrary unit, the operator must convert this measurement into terms of the correction means actually being used on the job. For instance, it might be necessary to determine the depth of drilling, grams of weight to add, length of wire solder, or number of correction washers to be attached. The conversion of the machine measurement to practical correction units can be accomplished by use of a "calibration constant"—a number by which the machine indication is multiplied to determine the amount of correction units which must be applied.

Computation by the operator may be avoided by using a correction chart such as the one shown in Table 5, in which the increments must be fairly large if the chart is to be of practical size. Machine operators generally prefer the trial-and-error application of corrections to the use of a calibration constant or correction chart for accurate determination of the amount of correction required. However, production suffers when it depends on the trial-and-error skill of the operator.

After adjustment for a particular job, the amount of correction required can be shown directly on the balancing machine amount-dial in terms of the means actually being used: for instance, number of sixty-fourths of an inch for depth of selected hole size, number of eighths of an inch of wire solder, or number of washers.

Speed of Rotation of Work-Piece During Balancing

A specification for the work-piece speed during balancing may be omitted if only one type of work-piece is to be balanced on the machine. If

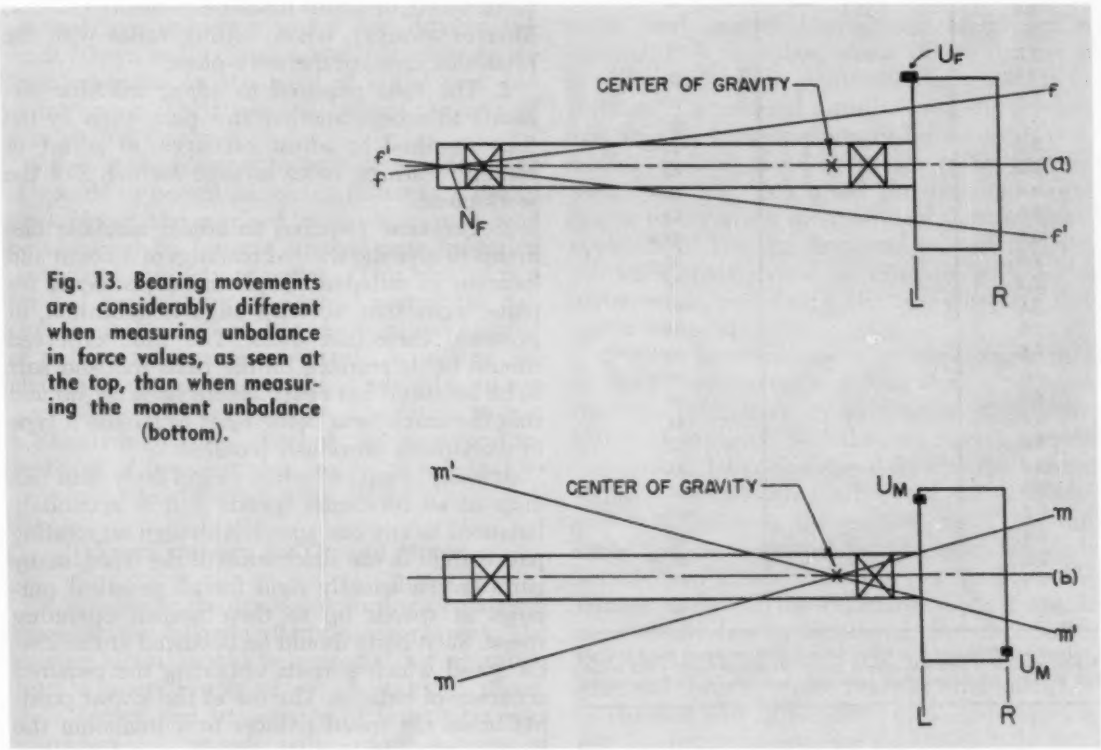


Fig. 13. Bearing movements are considerably different when measuring unbalance in force values, as seen at the top, than when measuring the moment unbalance (bottom).

Table 5. Depth of Holes to be Drilled for Various Amounts of Unbalance

Amount of Unbalance, Ounce-Inches	Depth to be Drilled, in Thirty-Seconds of an Inch, with a 1/2-Inch Diameter Drill, Depth Measured from Drill Point (Ground to 31°) *	
	One Hole	Two Holes
0.2	6	
0.4	8	
0.6	11−	
0.8	13	
1.0	16−	
1.2	17	
1.4	18+	
1.6	20	
1.8	22−	
2.0	23	
2.2	25−	
2.4	26+	
2.6	28	
2.8	30	
3.0	31+	
3.2	33−	
3.4	34+	
3.6	36	
3.8	38−	
4.0	39+	
4.2	41	
4.4	43−	
4.6	44+	
4.8	45+	
5.0	47	
5.2	49−	
5.4		29+
5.6		30
5.8		31−
6.0		31+
6.2		32
6.4		33−
6.6		34
6.8		34+
7.0		35+
7.2		36
7.4		37
7.6		38−
7.8		38+
8.0		39+
8.2		40
8.4		41
8.6		42
8.8		43−
9.0		43+
9.2		44+
9.4		45
9.6		45+
9.8		46
10.0		47

* Holes are drilled at 4 3/4-inch radius. Plus or minus signs indicate 1/64 inch above or below the depth given. Maximum depth 1 1/2 inches. Drill through 3 3/8-inch thick steel plate and into lead counterweight.

not, it should be specified that the balancing machine should be capable of measuring and locating unbalance with the work-piece rotating at a speed of .... rpm, or at any speed between .... and .... rpm. The selected speed for balancing within this range should be obtained by changing the driving pulleys, or adjusting a potentiometer which varies the speed of the motor driving the work-piece.

To test the machine for work-piece speed, it should be set up with the largest test rotor and arranged for rotation at the maximum balancing speed given in the specification. Also, it should be set up so that it can measure and locate unbalance to satisfy the preceding specifications. Observe and record the steps and equipment required to measure and locate unbalance in the smallest test rotor to satisfy the preceding specifications, where the test rotor is running at the lowest speed given in the specification.

For each setup the machine should be arranged to satisfy the specification for accurate amount indications previously described. The change-over time will be made up of three major items which should be carefully and separately timed. They are:

1. The time required to arrange for driving the work at a new rotational speed; such as the time to change belts and pulleys, adjust and note work-piece speed, or adjust machine elements (such as filter or springs), whose setting varies with the rotational speed of the work-piece.

2. The time required to adjust machine elements to accept another size part; such as the time required to adjust carriages, to adjust or change bearings, or to arrange for drive of the work-piece.

3. The time required to adjust machine elements to give the wanted readings of amount and location of unbalance; such as adjustments for plane separation, accurate angular indication, or practical correction units. The time observed should be determined on the basis that the part to be balanced has never before been set up and that the machine is being reset to handle a type of work-piece previously handled.

Actually, a part which is a rigid body is in balance at all rotational speeds if it is accurately balanced to any one speed. Although no rotating part is rigid in the strict sense of the word, many parts are sufficiently rigid for all practical purposes at speeds up to their normal operating speed. Such parts should be balanced at the lowest speed which permits obtaining the required accuracy of balance. The use of the lowest possible balancing speed reduces to a minimum the time required to bring the work up to balancing

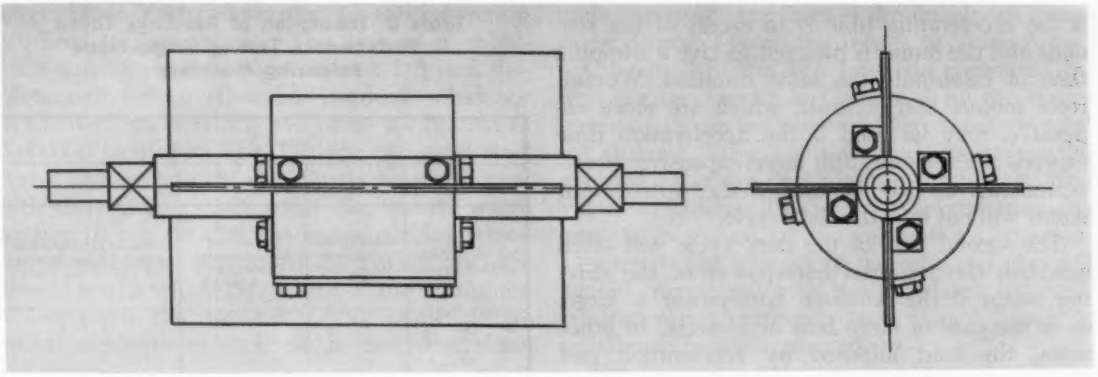


Fig. 14. In testing the performance of a balancing machine driving motor with a test rotor, windage and friction hp can be determined by adding fan-like members to the test rotor.

speed and the time required to stop the part after unbalance measurements have been taken. In this way, production is increased.

Parts which are not truly rigid bodies at their normal running speeds must be balanced at speeds which give each part the same shape as it will have under normal operation. This may make necessary the use of a wide variety of speeds at which different parts are rotated while measuring and locating unbalance. The use of a single balancing speed permits the use of a squirrel-cage induction motor for driving the work. These motors with associated controls are least expensive on the basis of initial cost and maintenance. Their use will reduce the cost of a balancing machine.

When it is necessary to provide a wide range of speeds to permit balancing different types of work-pieces, the required work-piece speed may be obtained by using a squirrel-cage induction motor and a variety of pulleys. This type of motor and control keeps the initial cost of the balancing machine down, but the required number of pulleys for a variety of work, as well as the change-over time, may make it advisable to use a variable-speed motor drive. The latter have a relatively high initial cost but may be a good investment if frequent change-over is required to accommodate different work-pieces.

Specifications for Driving Motor

In specifying the driving motor for a balancing machine, the following items are important. The driving motor should be arranged for operation from a power supply of .... volts, ... phase, ... cycles, and be capable of bringing a part weighing .... pounds, with a polar moment of inertia of .... pound-feet squared, up to a balancing speed of .... rpm in .... seconds; running the part at the balancing speed for thirty seconds with a windage and friction load of .... hp, and stopping the part in .... seconds. After a rest period of one minute, the motor should be capable of repeating this cycle. Also, the motor and control should (or should not) meet JIC specifications, and should have a constant (or variable) speed.

To insure conformity with specifications, the motor and control nameplates should be inspected. It is desirable, where practical, that an actual sample of the work-piece be available for this test. If a test rotor must be used, the windage and friction horsepower may be established by adding suitable fan-like members to the test rotor (see Fig. 14), until the required horsepower to drive the rotor at the balancing speed is obtained. The time required to start and stop the work-piece should be checked with a stop watch while performing the two complete duty cycles required.

Few machines impose as severe a requirement on the driving motor and control as a balancing machine. The duty cycle consists of bringing the work-piece up to balancing speed, running the work at balancing speed for the few seconds required to measure and locate the unblance, and then bringing the part to rest. This duty cycle can be repeated by the operator under actual shop conditions after an interval of a minute or less if the unbalance indications are accidentally lost or destroyed. For this reason, the specification should be written to impose practical shop conditions on the equipment.

The first part of the duty cycle generally cannot be met by a squirrel-cage induction motor

if the accelerating time is in excess of ten seconds and the motor is plugged to give a stopping time of essentially the same duration. Wound-rotor motors and controls, which are more expensive, may be used if the acceleration time exceeds ten seconds. Still more expensive direct-current drives may be used if the wound-rotor motor will not take the duty cycle.

The second part of the duty cycle will often establish the required horsepower of the driving motor if the windage horsepower is large, as in the case of large fans or blowers. In other cases, the load imposed by acceleration and stopping establishes motor size. The third part of the duty cycle may or may not impose a load on the motor. If the motor is not used to bring the work-piece to rest quickly, the duty cycle on the motor is substantially reduced, and a smaller motor and control will often suffice. This reduced initial investment is obtained only at the expense of higher production costs on every part produced, unless adequate braking is otherwise provided. In this case there will be little, if any, saving in initial investment.

Installation and Service Requirements

The supplier of the balancing machine should provide facilities for making all performance tests in the presence of the buyer's representative, prior to delivery at the supplier's plant. The supplier should provide a service engineer to install the machine, who will also instruct operating and maintenance personnel for a period of five consecutive days. The service engineer should be available within forty-eight hours after being requested.

All performance tests should be made in the presence of the buyer's representative. The number and availability of service engineers should be carefully investigated by him to insure that the supplier can comply with the specification. Only a limited number, if any, of the operating and maintenance personnel in today's factories understand balancing machines and procedures. There should be a broad dissemination of information on the balancing machine and procedures if maximum return is to be realized from the investment in a balancing machine.

Floor-to-Floor and Setup Times

Suggested specifications for setup and production times should include the following points: The floor-to-floor time for measuring and locating unbalance in each of two planes in practical correction units in part No. .... should be .... seconds. The time required for setting up part No. .... the first time should be .... minutes. The time required to return to the setup for part No. .... should be .... minutes.

Table 6. Tabulation of Readings Taken in Performance Testing Single-Plane Balancing Machines

Column Number			
1	2	3	4
No. of *U* Units of Unbalance	Reading of Unbalance Measuring Device	Ratio of Unbalance Measurement Reading to Number of *U* Units	Permissible Deviation of Col. 3 from Average of Col. 3, Per Cent
2			12 1/2
5			5
10			2 1/2
20			1 1/4
Total	...		...
Average	...		...

The parts used for this specification should differ from each other as much as possible in weight, size, distance between bearings, size of bearings, and other features. If specific work-pieces are not available, the smallest and largest test rotors should be used. The total time required to load the smallest rotor into the balancer should be observed and recorded. Then measure and locate the unbalance in each of two planes (in practical correction units), and unload the part. This floor-to-floor time should not exceed that specified. Also observe and record the total time required to set up the balancing machine to measure (in practical correction units) and locate the unbalance in two planes selected by the inspector for the largest rotor. Finally, observe and record the time required to return the balancing machine to the setup for the smallest rotor.

Single-Plane Balancing Machines

Disc-shaped parts can frequently be given a satisfactory balance by applying a single correction. Generally speaking, rotating type "static" balancing machines are needed to meet today's requirement for accuracy. The following specifications and performance tests are recommended as a basis on which to purchase such equipment.

The balancing machine should indicate directly the amount and location of the single correction required to give balance. Operate the machine and observe whether it does give a single reading of amount of unbalance or a

single reading of the location of the correction required to give balance. The amount-of-unbalance indicator should have at least 1/8-inch displacement for an allowable residual unbalance in the work-piece which will cause a vibration of 0.000050 inch of its axis. Provide two solid steel test discs, each with a thickness equal to one-fifth their diameter. One test disc should weigh within 10 per cent of the minimum for which the machine was purchased. The other test disc should weigh within 5 per cent of the maximum.

Determine the ounce-inches of allowable residual unblance in each of the test discs from the formula:

$$U = 16\ Wd$$

in which U = allowable residual unbalance, in ounce-inches;
W = weight of the test disc, in pounds;
d = balancing accuracy, in inches, in terms of allowable vibration—this will be 0.00005 inch for the suggested specification.

Provide unbalances for each test disc equal to two, five, ten, and twenty times U. The weight required to introduce a given unbalance at a given radius may be determined by using the following formula:

$$w = \frac{U}{r}$$

in which w = weight of the wanted unbalance, in ounces;
U = unbalance, in ounce-inches, and
r = radius, in inches, at which the weight may be added.

Balance the smallest test disc as accurately as possible, using the lowest balancing speed for which the machine is supplied. In turn, add an unbalance of two, five, ten, and twenty times U, and observe the readings of the unbalance measuring device. Record the results in Table 6.

Column 3 of Table 6 must be computed by dividing the results in Column 2 by the corresponding values in Column 1. Determine the total for Column 3 by addition, and determine the average value by dividing the total by 4. The values in Column 3 should not deviate from the average in excess of the percentages given in Column 4. The average of the ratio in Column 3 should correspond with the unbalance indicator reading which represents more than 1/2 inch of unbalance indicator movement.

The balancing machine should accurately locate the point where the correction for balance should be made. The unbalance location should be read on a continuous scale with no requirement for the operator to change scale for specific values of unbalance location. Indications of unbalance location should be stable. Balance the smallest test disc as accurately as possible. Introduce unbalance of two, five, ten, and twenty times U, and record the results in Table 7. The results must be within the acceptable values.

Response to Extraneous Vibration

The balancing machine should be suitable for mounting directly on a floor, without requiring a special foundation or vibration-isolation devices. The equivalent displacement effect on the amount-of-unbalance measuring device shall be no more than 15 per cent of the amplitude of either, or both, horizontal and vertical floor vibrations.

For this test the machine should be mounted on a shaker table capable of producing the total displacements of 0.003 inch at the balancing speed specified. Use the lowest balancing speed if a range of speeds is specified. The displacements should be produced in two directions

Table 7. Form Used to Record Data When Balancing Smallest Test Disc

No. of *U* Units of Unbalance	Actual Location, Degrees	Machine Reading, Degrees	Machine Error, Degrees	Acceptable Error, Degrees	Instability of Reading, Degrees	Permissible Instability, Degrees
2	0			15		7 1/2
5	0			6		3
10	0			3		1 1/2
20	0			1 1/2		1
2	180			15		7 1/2
5	180			6		3
10	180			3		1 1/2
20	180			1 1/2		1

which are 90 degrees apart, and each of which are the same distance from the rotational axis of the test disc. Both displacements may occur simultaneously with no unwanted influence on the test, but it is not necessary for vibrations in both directions to occur simultaneously.

If a shaker table is not available, the machine may be mounted on the test platform described previously. If the test platform is used, two series of tests should be made. The first series can be made with the machine base in any position with respect to the exciter shaft, but with the center of mass of the machine approximately above the mid-point of the platform. The second series of tests should be made with the machine base moved 90 degrees about a vertical axis with respect to its position on the platform for the first test. Vibration of the shaker table should be checked as previously described.

With an unbalance equal to ten times U in the smallest test disc, and with the balancing machine operating so as to give unbalance indicator readings of the same value as were recorded in Table 6 of this section, observe and note the unbalance indicator readings. Without stopping the balancing machine, start the shaker table platform at the above displacements, and note the unbalance reading. Substitute these readings in the following expression and solve:

$$5555 \frac{U}{W}\left(\frac{M_2}{M_1}-1\right) = \text{response factor}$$

in which U = allowable residual unbalance of the work-piece being considered, in ounce-inches

W = the weight of the work-piece, in pounds

M_1 = the unbalance indicator reading noted without the shaker table operating, and

M_2 = the Unbalance indicator reading noted with the shaker table operating.

To satisfy the specification, the response factor for the unbalance indicator readings obtained should be 1.0 or less. This test should be repeated for both vertical and horizontal vibration displacements if the shaker table provides these vibrations separately. It also should be repeated for the balancing machine turned 90 degrees on the shaker table.

The surfaces of the balancing machine spindle on which the work-piece locates should introduce negligible unbalance effects because of runout of those surfaces with respect to the spindle bearings. With the balancing machine at its most sensitive position, the largest test disc should be balanced until there remains less than one-half the permissible residual unbalance. Remove the test disc from the spindle, and remount it on the spindle exactly 180 degrees from its previous position. Run the machine and observe the unbalance indicator reading. The unbalance indication should not exceed one and one-half times the permissible residual unbalance.

The balancing machine should incorporate adjustable means whereby the unbalance measuring device may be calibrated to show the required correction in terms of the correction units actually being used. To test this requirement, place the smallest test disc in the machine. Balance the rotor with the machine at maximum sensitivity. Introduce a twenty-times-U unbalance in the disc. With the test disc running, calibrate the unbalance measuring device to read exactly 20. Then, calibrate the unbalance measuring device to read exactly 13 for the twenty-times-U unbalance. Repeat the change of calibration to cause the unbalance measuring device to read any other number between 5 and 20. Finally, repeat for eight other arbitrarily selected numbers between 5 and 20.

The following information on the work to be done by the machine should be supplied as an integral and detailed part of a balancing machine specification.

1. A detailed, dimensioned drawing of the part in the condition that it will be when delivered to the balancing machine. This drawing should give maximum diameter of part, maximum length of part, and weight.
2. The drawing should show permissible places where correction for balance may be applied and the proposed method of applying correction.
3. The drawing should show clearly the location at which the part is supported by bearings or the surfaces which give it location in its final assembly. If the part is to be balanced on anti-friction bearings, the size and location of the bearings should be shown.
4. Normal operating speed or speed range of the part.
5. If the part is not a rigid body under its normal operating condition, give the first and second critical speeds of the part.
6. If the part has an irregular periphery so that when rotating it causes appreciable movement of air, give the horsepower required to drive the part at a suggested balancing speed.
7. Production required. If the production is on a weekly, monthly, or annual basis, give the total number of hours the balancer will run per week, per month, or per year.
8. If the balancer must handle more than one type of part, give the maximum and minimum size of lot.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Versatile Boring-Bar Holder for Lathe Operations

RICHARD MINSER, Cleveland, Ohio

A holder that will accommodate various sizes of boring-bars without the necessity of using adapters, and which will automatically position the center of the bar in line with the lathe spindle, is shown at X in the accompanying illustration. The holder consists primarily of a steel block that has a V-groove on one side. The bottom of the vee is positioned at the same height as the center line of the lathe spindle.

Two clamps that are fitted with cap-screws are provided to hold the boring-bar in the V-groove. These clamps are made flat on one side to accommodate large-diameter bars, and have a high shoulder on the opposite side to permit adequate clamping of small-diameter boring-bars. A square washer is provided which fits the T-slot on the compound rest. This washer is mounted on a shouldered bushing that extends upward into the boring-bar holder. A spacer is ordinarily supplied between the compound rest and the holder, but this spacer may be omitted in cases where the height of the spindle center above the compound rest is a short dimension. A cap-screw held to the top of the block by means of a washer engages a tapped hole in the bushing to lock the holder assembly on the compound rest.

An added advantage of this type of holder is that provisions can readily be made for locating the tip of the boring tool at the exact height of the spindle center line, or at desired amounts above or below the center line. To provide for such settings, a flat surface is milled on the bar exactly 180 degrees from the tip of the tool when it coincides with the lathe spindle center line. This will insure that the tool is automatically set to the desired height by simply placing the bar in the holder and tightening up the clamps.

Variations in the height of the tool tip can be obtained by tightening the lower clamp screws more than the upper screws, if it is desired that the tool point be high with respect to the spindle center line, as shown in the right-hand diagram

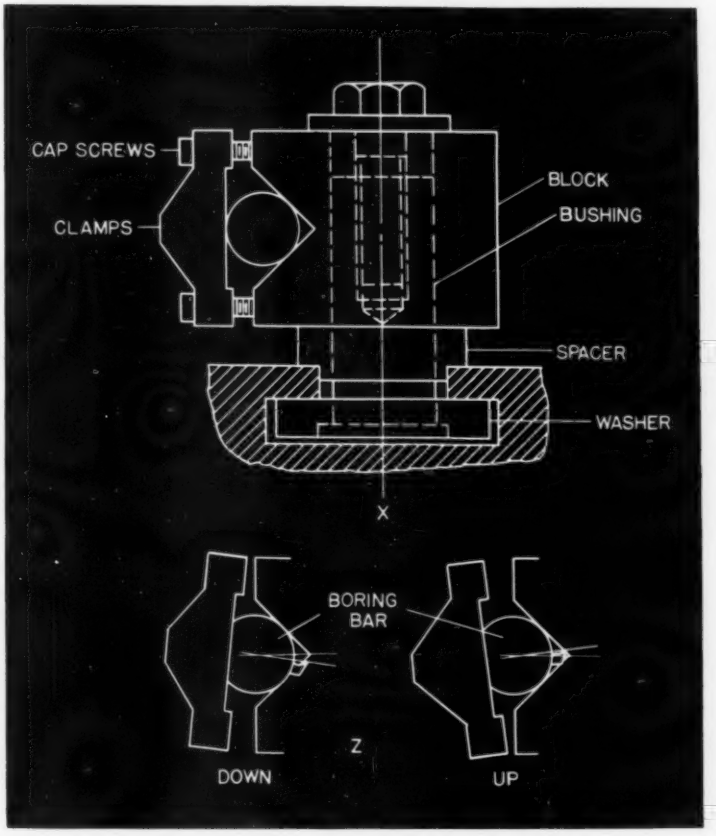


Diagram showing the construction and operational possibilities of a versatile boring-bar holder.

at Z. On the other hand, if it is desired that the tool point be low with respect to the spindle center line, the operator would tighten the upper clamp screws more than the lower clamp screws in order to obtain the condition indicated by the left-hand diagram at Z.

This boring-bar holder should be considered a permanent part of the accessories for any particular lathe because, due to the different heights from the top of the compound rest to the spindle center line on different machines, the unit is not generally interchangeable from one lathe to another. The conventional toolpost of the lathe is, of course, replaced by the boring-bar holder.

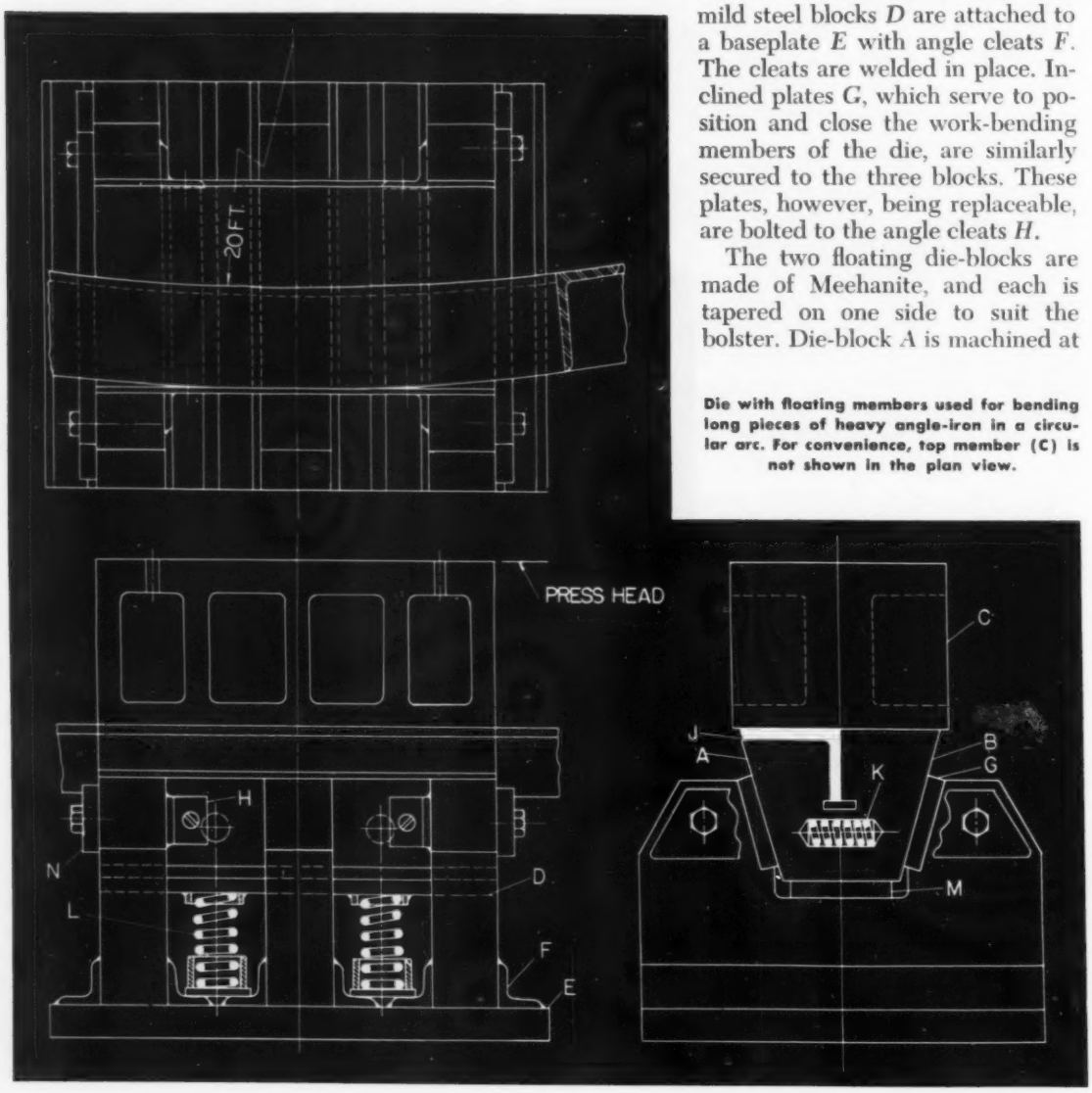
Die with Floating Members for Bending Heavy Angle-Iron

A. G. Amos, Calcutta, India

Long pieces of angle-iron can be readily bent to a large radius with the die here illustrated. The work-piece is fed in successive increments of length between two floating die-blocks having curved forming surfaces that produce the desired radius in the angle-iron.

Essentially, the die consists of a bottom bolster, two floating die-blocks *A* and *B*, and a top member *C*. To form the bolster, three mild steel blocks *D* are attached to a baseplate *E* with angle cleats *F*. The cleats are welded in place. Inclined plates *G*, which serve to position and close the work-bending members of the die, are similarly secured to the three blocks. These plates, however, being replaceable, are bolted to the angle cleats *H*.

The two floating die-blocks are made of Meehanite, and each is tapered on one side to suit the bolster. Die-block *A* is machined at



Die with floating members used for bending long pieces of heavy angle-iron in a circular arc. For convenience, top member (C) is not shown in the plan view.

the top and the vertical side to allow for the work-piece *J*. All vertical surfaces contacting the angle-iron are machined at the curvature required for the bend.

These curved surfaces must necessarily have a radius smaller than that of the desired bend since allowance must be made for spring-back. Contact between the die-blocks and the inclined plates is maintained by two springs *K*. After each press stroke, an upward floating movement of about 2 inches is provided to the die-blocks by springs *L* and a push plate *M*. Retaining plates *N* prevent end movement of the floating blocks.

In operation, one end of the angle-iron is placed between the floating blocks, and the press is tripped. As the ram descends, the top member *C* forces the floating blocks down and the inclined plates close the die on the work-piece. After this first portion is bent, the die-blocks open and return to their raised positions. The work-piece is then advanced between the floating blocks for almost the length of the die, and the press is again tripped. This procedure is continued until the entire angle-iron is bent in an uninterrupted curve of the desired radius.

Actually, the particular die shown is 2 feet long and was used on a 290-ton hydraulic press to bend 6- by 4- by 3/8-inch angle sections in lengths of over 20 feet. The floating blocks were designed to produce a radius of 20 feet.

Handy Feed-Lever Switch Facilitates Drilling

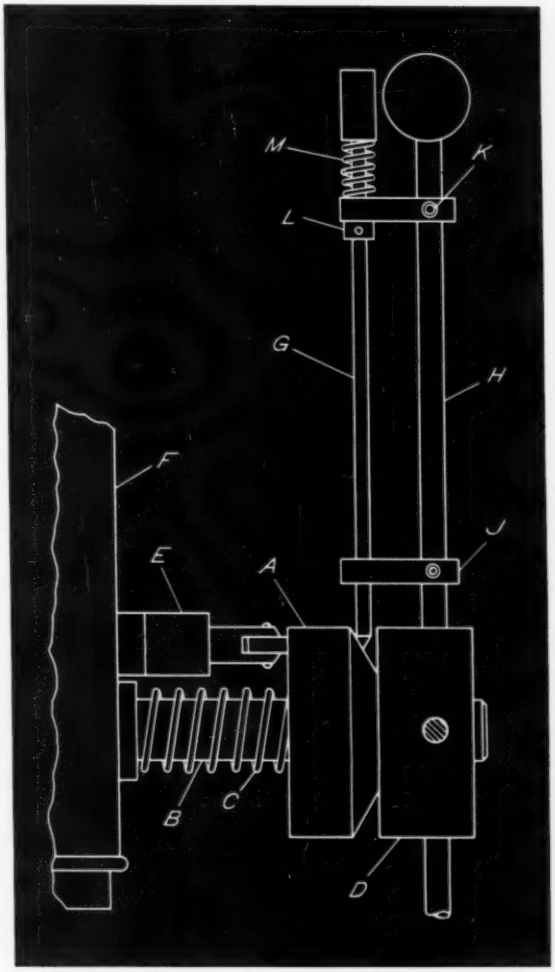
CLINT MCLAUGHLIN, Rockaway Beach, N. Y.

A micro switch and push-rod attached to the feed mechanism of a drilling machine provide a convenient power control. With such an arrangement, as here illustrated, a mechanic can start or stop his machine without releasing the feed-lever. The switch is especially useful where much tool changing or work adjustment is required.

Collar *A* is chamfered on one edge and made a sliding fit on feed-shaft *B*. Spring *C*, also mounted on the feed-shaft, serves to hold the chamfered face of the collar in contact with hub *D*. A micro switch *E* is secured to the machine column *F* so that the roller on the plunger is in contact with the unchamfered face of collar *A*.

A pointed switch-rod *G* is attached to the feed-lever *H* by two short blocks *J*. These are held in place by set-screws *K*. A pinned collar *L* and a spring *M* keep the pointed rod just out of contact with the chamfer on collar *A*. Depressing the switch-rod moves both the collar on the feed-shaft and the micro switch plunger to the left. This action is sufficient to turn on the power at the machine. The micro switch is connected parallel to the regular switch.

In operation, the mechanic can feed the tool down, line it up with the work, depress the switch-rod, and start drilling—thus keeping his hand on the feed-lever. There are also many occasions when cutting tools must be changed several times while machining a single work-piece. With this setup, the operator does not have to grope for the switch while substituting tools.



Arrangement that permits power for drilling machine to be turned on or off without releasing the feed-lever.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Calculating the Radius of a Spherical Segment

W. W. JOHNSON

A sheet-metal stamping in the form of a spherical segment with a flange is shown in Fig. 1. To make the forming die for this part, radius R must first be calculated with the aid of the diagram in Fig. 2 and some algebraic manipulation.

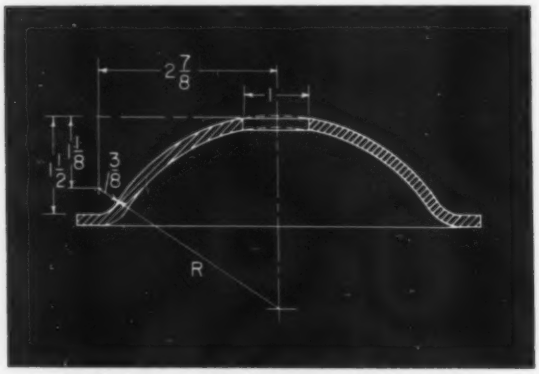


Fig. 1. Flanged spherical segment for which radius (R) must be calculated.

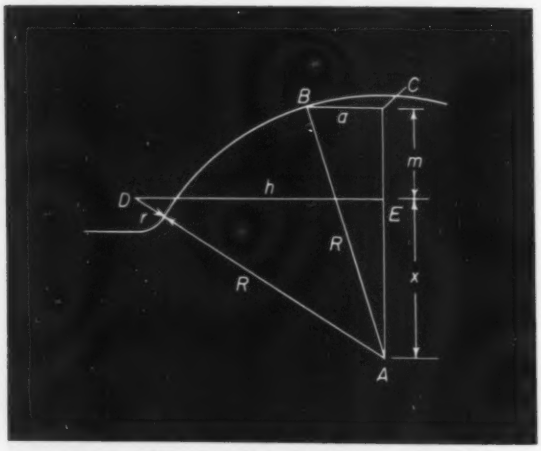


Fig. 2. Diagram used in calculating radius (R).

Solution:

To avoid the use of fractions, all dimensions are first multiplied by 8; then $h = 23$, $m = 9$, $r = 3$, and $a = 4$.

In triangle ABC,

$$\begin{aligned} R^2 &= a^2 + (x + m)^2 \\ &= 4^2 + (x + 9)^2 \\ &= x^2 + 18x + 97 \\ x^2 + 18x + 97 - R^2 &= 0 \end{aligned} \tag{1}$$

In triangle ADE,

$$\begin{aligned} (R + r)^2 &= x^2 + h^2 \\ (R + 3)^2 &= x^2 + 23^2 \\ R^2 + 6R - 520 - x^2 &= 0 \end{aligned} \tag{2}$$

Eliminating x^2 between (1) and (2) and solving for x,

$$x = \frac{423 - 6R}{18} \tag{3}$$

Substituting (3) in (2),

$$288R^2 + 7020R - 347{,}409 = 0$$

Dividing through by 9,

$$32R^2 + 780R - 38{,}601 = 0$$

Using the quadratic formula,

$$R = \frac{-780 \pm \sqrt{(780)^2 - 4(32)\,(-38{,}601)}}{2 \times 32}$$

Dividing numerator and denominator of the right-hand member by 4 to reduce the size of the numbers handled,

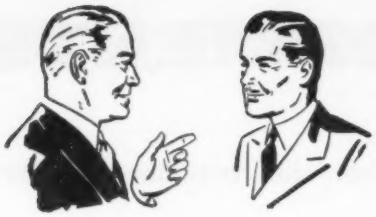
$$R = \frac{-195 \pm \sqrt{(195)^2 + 8 \times 38{,}601}}{16}$$

$$= \frac{-195 \pm 588.925}{16}$$

$$= \frac{393.925}{16} = 24.6203$$

Since 24.6203 is 8 times the true value of R,

$$R = 24.6203 \div 8 = 3.0775$$



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Cost Savings—the Prime Sales Opportunity

THE DECLINE of profits began almost unnoticed some six years ago. Since then most industries have grown in sales volume, yet have experienced a shrinking profit percentage. The 1957 reports of many corporations constituting the sales engineers' market feature statements like these: "This year we faced increased business costs."—"A narrowing margin of profit was experienced."—"Costs rise but competition prevents the lifting of prices."—"Urgent plans are in effect for the purpose of adding even small increments of savings."

The aim in buying at present is to escape getting squeezed between the price ceiling and the cost floor. Since our job is to sell ways of producing better and cheaper, we face a greater challenge and opportunity. But neither will be met unless we sharpen our search in the plant and in processes for chances to save; then load each sales attack with cost-saving facts and persuasion.

The title "Cost Engineer" is now recognized, just as "Safety Engineer" became well known years ago. Less than two years ago sixty men met and formed The American Association of Cost Engineers. It now has a membership of many hundreds. The cost engineer has become a key man—cost engineering a professional function.

The cost engineer trains his eye on one situation after another. Though his broad aim is to lower costs by eliminating some operations, his recommendations usually provide for substituting new operations and facilities for those already in use.

The cost engineer's analytical work helps generate further cost consciousness in other employes—especially the designer, shop official, and estimator, who move in a world of specifications and costs.

Although cost saving is basic to sales engineering, we may have overlooked the degree to which it has captured the interest of industrialists. Cost saving has become a distinct part of research.

In a study of the current sales plans of a few sales managers, we have discovered one who is alive to cost-saving selling. What has he been doing?

1. On his desk are some significant figures assembled to show what has been happening to markets and customers of particular interest. This data indicates where to concentrate sales effort.

2. At the start this sales manager had established the idea that this cost-saving sales program should be one of selling a service *before* selling equipment. Many sales engineers had come to regard service only as maintenance.

3. When profits fall, product re-design is accelerated to achieve increased sales and decreased fabrication costs. Production facilities get a thorough review. This sales manager's strategy is to concentrate on customer's engineers assigned to create new products and processes.

4. Each sales engineer is being re-trained and re-directed to be a detective as well as a promoter. His job is to discover plans and detect people involved. His job is to promote cost-saving ideas.

5. Advertising in engineering and trade magazines has been slanted to show the prospect that he should study design and production from the point of view of savings. Of course, the "before and after" case, with ensuing savings, receives emphasis.

6. Some forms of promotional literature are being revised to emphasize increased savings in contrast to expanded production volume. The wisdom of frequently altering literature in order to meet the customer's changing buying interests is often overlooked.

7. Case studies, supplemented by photographs of equipment and people, and supported by statistical data on how to save, have been provided for each sales engineer. Cost-saving advantages are made real to the prospect, especially by showing him how others have solved a similar problem.

8. Within his own department this sales manager has carried on the search to expose waste—particularly to increase efficiency at headquarters and in the field.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and

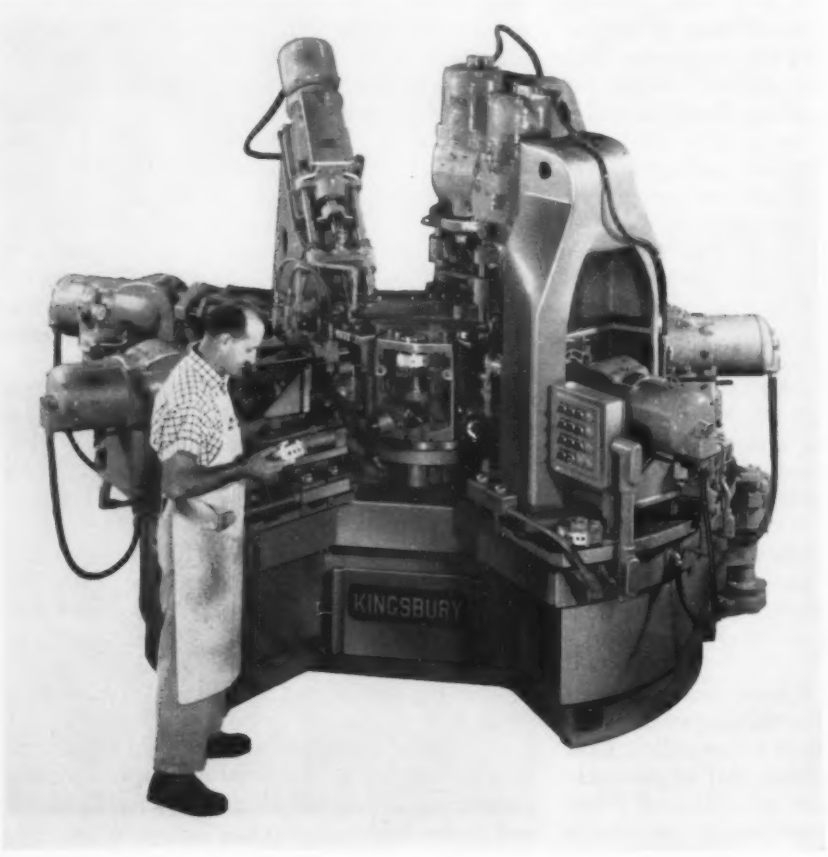
Kingsbury Multi-Unit Automatic for Processing Automatic Transmission Parts

A multi-unit automatic drilling machine recently brought out by the Kingsbury Machine Tool Corporation, Keene, N. H., drills, reams, countersinks, and flat-bottoms the holes in die-castings for automatic transmissions at a gross production rate of 240 parts per hour. Eight units having a total of eleven spindles perform the operations necessary to process the die-cast parts. Ten work fixtures mounted on a 30-inch indexing table hold the work-pieces. An air cylinder located at the left of the operator's position serves to clamp and unclamp the fixtures.

Five horizontal units, four of which can be seen in the illustration, are equipped with eight tools that process two holes. Two vertical units are tooled up to drill and ream one hole. Another unit, positioned at an angle, drills downward at an angle of 45 degrees and off the radial center line at an angle of 105 degrees. Ten of the eleven tools used in this machine are guided accurately by properly positioned bushings.

Versatility in design that makes it possible to employ units for accurate drilling or other operations at practically any desired angle is a feature of this type of automatic machine that makes it readily adaptable to the rapid economical processing of automotive parts.

Circle Item 101 on postcard, page 195



Kingsbury multi-unit automatic with indexing table equipped to process die-castings for automatic transmissions

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

Clearing 600-Ton Automatic Hydraulic Scrap Shear

A revolutionary new automatic scrap shear of giant size is undergoing final tests in the Chicago plant of the Clearing Machine Corporation. The machine, weighing about 335,000 pounds, is two and one-half stories high and is rugged enough to take the punishment of full time outdoor operation, yet is designed with all the precision of the manufacturer's metalworking presses. This gigantic scrap shear is said to be the only 600-ton, self-contained, completely automatic hydraulic shear now available. Only electrical connections are required to begin operation after it has been set up. The operating mechanism is totally enclosed and weather-proofed to permit all-weather outdoor use.

Viewed from the front, the new machine resembles one of Clearing's large hydraulic presses. However, at the rear of this press there is a 22-foot long, hydraulically tilted hopper and a feed box which houses the hydraulic ram that feeds scrap to adjustable, heavy-duty, alloy shear blades. The scrap shear will cut almost any kind of heterogeneous scrap into equal lengths, adjustable in 6-inch increments from 6 to 48 inches.

It is claimed that one of these scrap shears will be able to do the work of five or six conventional alligator type shears ordinarily used by the scrap industry. In addition, the new shear virtually eliminates the need for torch cutting in the yard. Developing up to 600 tons of pressure, it will cut up to 30 tons of scrap per hour.

Operation of the shear is simple, a magnetic yard crane being used to load the hopper with scrap. When the hopper is full, the operator pushes a "Start" button. The hopper is hydraulically elevated, and dumps the contents into the feed box. A lid on the box closes under a pressure of 95 tons, and the hopper automatically returns to its original position.

The hydraulic ram in the feed box moves forward a pre-set distance equal to the length of cut, pushing scrap under the shear blades. A 100-ton hold-down device locks down, keeping the scrap firmly in place. Then the shear slide is automatically actuated, shearing the scrap charge. The shear slide rises, hold-down pressure is released, and the ram moves forward to start another cycle. The cycle is automatically repeated until all the scrap has been sheared. While the shear is operating, the loading hopper may be refilled with the next charge of scrap. The same magnetic crane used for loading the hopper can pick up the sheared scrap and load it into railroad cars, or conveyorized equipment can be installed to remove the scrap.

Circle Item 102 on postcard, page 195

Huge hydraulically operated automatic scrap shear announced by the Clearing Machine Corporation

Special Machine Designed to Weigh and Automatically Mill Pistons to Predetermined Weight

The Snyder Tool & Engineering Co., Detroit, Mich., has designed and built a piston weigh-milling machine that automatically removes material from large diesel engine pistons in accordance with a precision weight measurement. A weight tolerance of plus or minus 0.02 pound is maintained in the milled parts. The machine handles aluminum or cast-iron pistons 4 3/8 inches in diameter, as well as aluminum pistons 3 5/8 inches in diameter. To enable a milling cutter on the machine to remove metal from the cast-iron and aluminum parts at maximum speed, a two-speed motor operating at 600 and 1800 rpm is provided for the spindle drive.

A built-in memory device in the electrically controlled machine automatically sets the depth of cut of the milling cutter according to readings of the precision electronic weight scale.

Hydraulic cylinders powered by an external hydraulic pump and tank unit clamp the part for the milling operation, feed the spindle, and make the automatic feed depth adjustments. A coolant system is provided for machining the aluminum parts. Net production rate is 261 pieces per hour for aluminum pistons and 192 pieces per hour for cast-iron pistons. The complete dual-material piston weigh-milling machine with its weigh scale unit, control panel, hydraulic tank, and coolant tank accessories occupies a floor space of about 10 by 7 1/2 feet.

Circle Item 103 on postcard, page 195

Snyder piston weigh-milling machine designed to handle aluminum and cast-iron pistons

Micro-projector announced by Opto-Metric Tools, Inc.

Wilder Floor Model Micro-Projector

Opto-Metric Tools, Inc., New York City, has announced the addition of a new floor Model A-F to their line of Wilder micro-projectors. This model is a fully self-contained and self-supporting unit of compact design for use at the side of a machine tool where space is at a premium. Every detail for maximum comfort and efficiency has been considered, including convenient height, inclined screen, toe space, and a grey hammertone finish for repelling dust and dirt. As optional equipment and without adding to the required floor space, an ingenious shelf is available for holding spare screens or charts, and for the laying aside of small parts.

This floor model is available in six selective magnifications and with a choice of three different measuring stages, centers, surface illumination and protractor as well as measuring screens.

Circle Item 104 on postcard, page 195

Production Machine with Vertically Opposed Spindles

Deburring, chamfering, spotfacing, drilling and/or tapping, reaming, and other related machining operations are possible individually, simultaneously, or in sequence with a completely automatic machine announced by the R. E. Ellis Engineering Co., Chi-

cago, Ill. This machine is designed for opposed operation and can be used with a small index-table, manual or air clamp fixtures, and hopper or vibration feed. It can be employed for deburring or chamfering holes on both sides of thin sections as well. Fixtures or tooling can be located quickly and accurately in precision machined cross-slots on the table.

The machine is furnished with two Dumore Series 24 automatic drill units that have a drilling capacity of 3/8 inch and a tapping capacity of 1/2-13 in mild steel, at 10 speeds ranging from 400 to 7420 rpm, obtained by interchanging pulleys. The controlled feed range is up to 60 inches per minute while the rapid approach rate is 600 inches and the return rate 300 inches per minute.

Maximum spindle stroke of each unit is 3 inches, while the largest opening between chucks at the rest position is 22 inches. Both units and table are adjustable vertically on a solid steel column through a gear, pinion, and rack. Normal spindle alignment from tool to tool is accurate within 0.003 inch.

These machines are available completely assembled with all technical controls built in, including a JIC electric panel with push-buttons and safety retract switch. An adjustable foot bar permits quick and easy actuating, leaving the hands free for handling the work-piece.

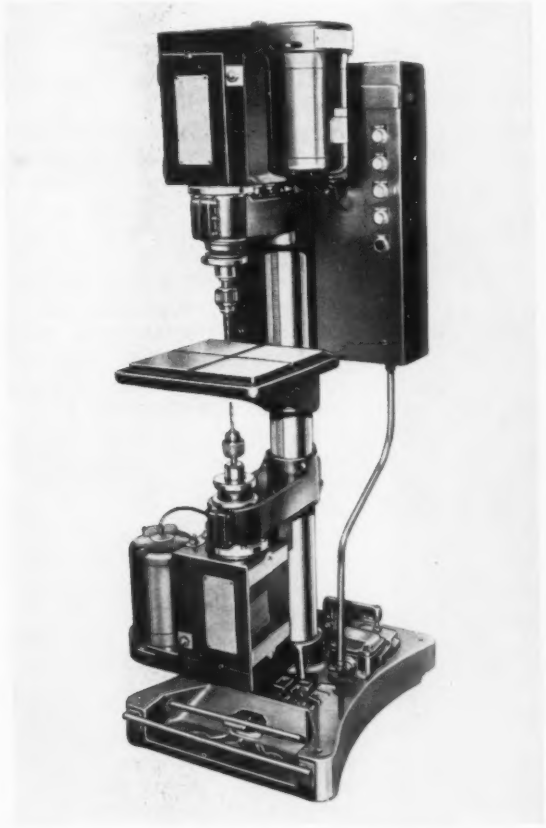
Circle Item 105 on postcard, page 195

Bliss Double-Action Enclosed Toggle Presses

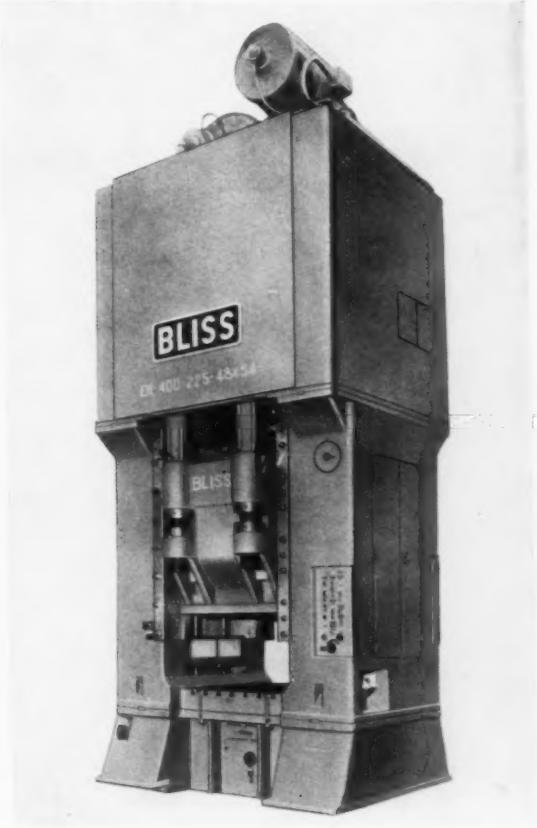
A new line of straight-side, one-point, double-action, enclosed toggle presses, known as the D-1 series, has been introduced by the E. W. Bliss Co., Canton, Ohio. The presses in this series are designed to JIC specifications and incorporate many new features. Capacity ratings range from 200 to 2000 tons. The presses are of welded steel construction, using a four-piece frame with tie-rods. Other features are a Bliss Type K clutch-and-brake; full eccentric on plunger drive with twin cranks on blankholder drive; twin main driving gears; a motorized plunger adjustment with a new standard barrel type adjustment on the plunger, and an easily serviced crown-mounted driveshaft.

Piping, electrical controls, main panel, limit and automation switches are enclosed in the uprights. A recirculating oil system lubricates gears, shaft bearings, flywheel bearings, and all toggle link bearings. Grease is automatically applied to blankholder ways, plunger ways, and blankholder wrist seats.

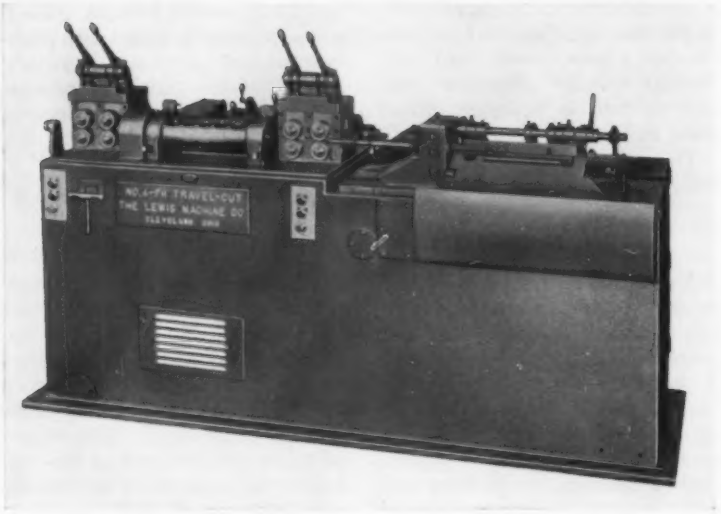
Circle Item 106 on postcard, page 195



Ellis machine with vertically opposed spindles for deburring, drilling, tapping, and related operations



Straight-side, one-point, double-action toggle press placed on the market by the E. W. Bliss Co.

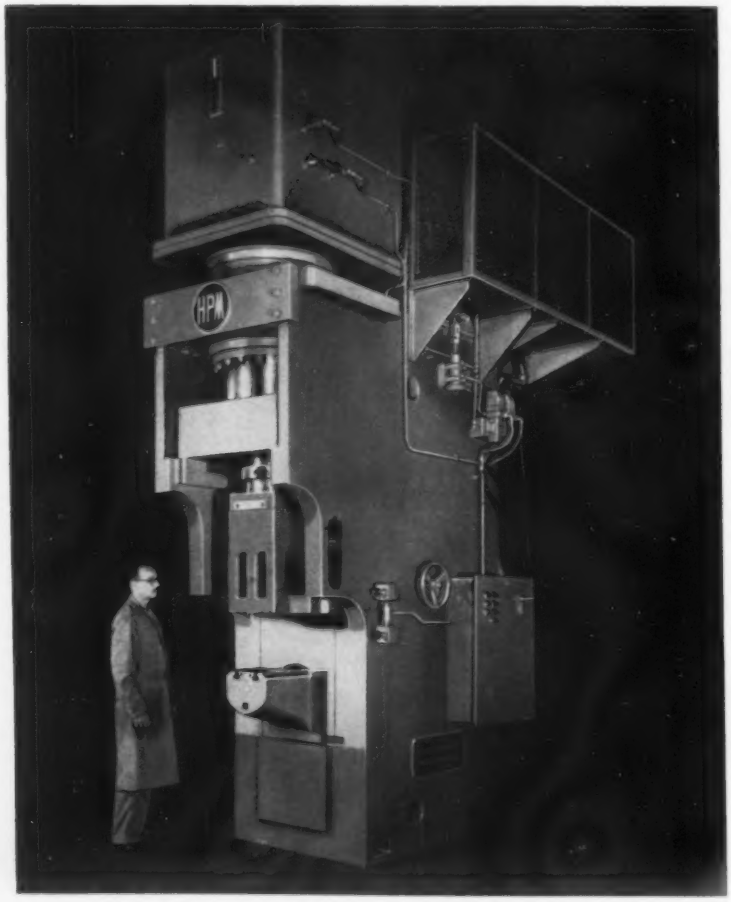


Lewis automatic wire straightening and cutting machine designed for high-speed operation

Automatic Flying-Shear Wire Straightening and Cutting Machine

The Lewis Machine Co., Cleveland, Ohio, has announced a special new machine for the high-speed cutting of commercial welding rod and similar short items. This Number 4FH "Travel-Cut" high-speed automatic flying-shear wire straightening and cutting machine has a capacity for handling mild steel from 3/32 to 1/4 inch in diameter. High carbon, alloy and stainless steels up to a maximum of 3/16 inch can be straightened and cut. Feed speeds range from 75 to 520 feet per minute. A smooth, positive-action, high-speed shear-actuating mechanism is attained without the use of loose links, cams, or springs.

Circle Item 107 on postcard, page 195



Open gap horn press built for automotive tire manufacturer by the Hydraulic Press Mfg. Co.

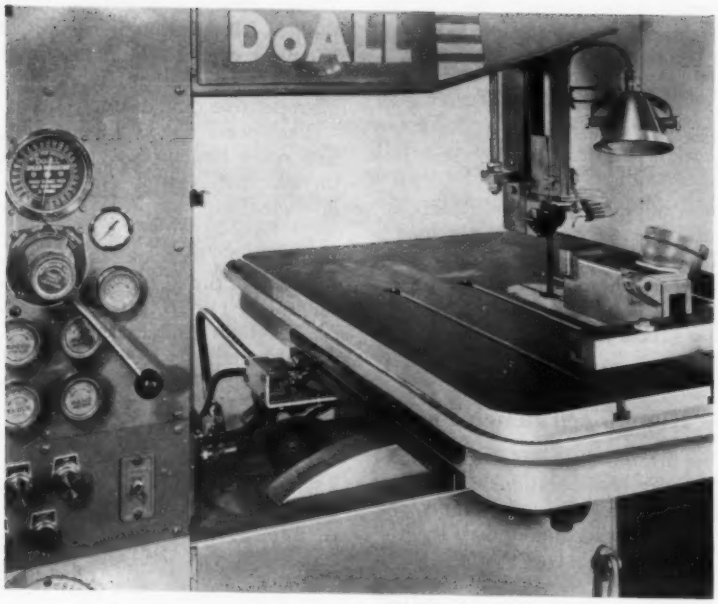
H-P-M Open Gap Horn Press

Three 500-ton open gap horn presses like the one illustrated have been built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for a large manufacturer of automotive tires. These presses have an 8-inch throat depth, 19 1/2-inch daylight capacity, 6-inch stroke, and moving slide area of 14 by 14 inches, and will be used for coining tire rims. They have frames of welded steel construction that are fully stress-relieved prior to machining. Equipment includes H-P-M's closed circuit Fastraverse system of operation with manual and automatic control.

The hydraulic power system incorporates one H-P-M 50-gallon-per-minute radial piston pump; piston type safety valves to prevent overloading the press and pump on both forward and return strokes; and a 50-hp electric motor.

Each press is approximately 16 feet in height, requires a 36- by 90-inch space at floor level, a 72- by 121-inch space at the power unit, and weighs approximately 76,800 pounds.

Circle Item 108 on postcard, page 195



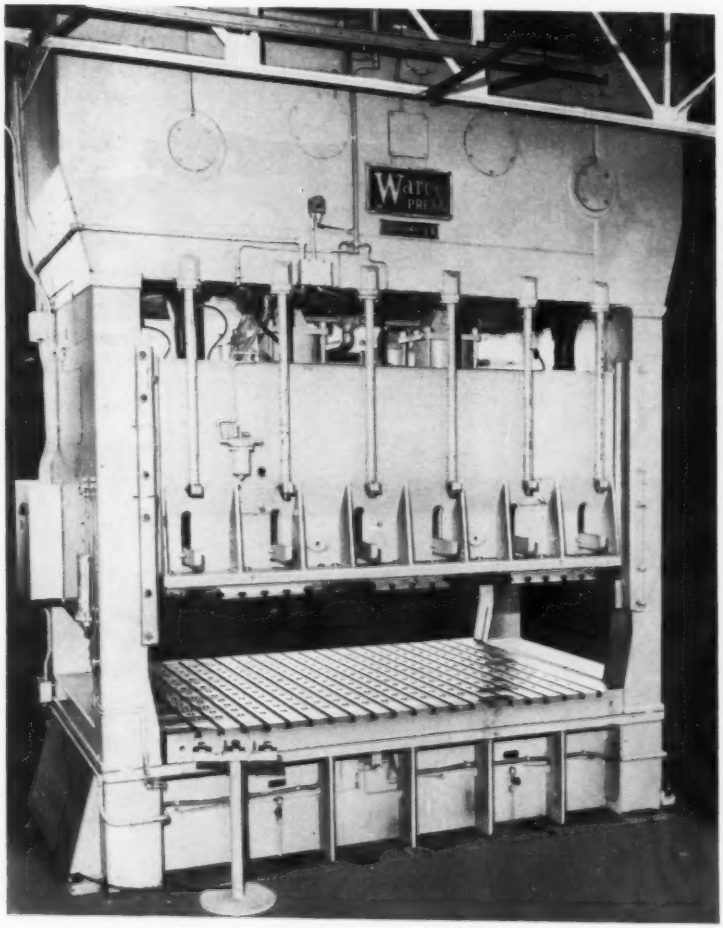
DoALL band machine with trip dog in table edge tee slot adjusted to trip table return switch at desired point

DoALL Band Machine with Single-Cycle Automatic Table Return

The Model 26-3 Production band machine made by the DoALL Co., Des Plaines, Ill., can now be equipped with single-cycle automatic table return to facilitate table control. After a sawing or slotting job is set up on the table, an adjustable trip dog on the table periphery is set for the desired length of cut. In operation, the trip dog, which can be seen in the illustration, engages a limit switch when the table reaches the desired infeed point, actuating a solenoid valve that acts to return the table to the loading position.

The table remains in the loading position until the cycle start button is pressed by the operator when another feed-stroke begins. Feed rate and pressure are established by the normal table hydraulic controls. Once set, these controls need not be touched during a production run. The operator is required only to unload and reload the work-holding fixture and engage the cycle start button. During the cutting stroke and automatic return, he is free to arrange finished and unfinished work-pieces for the most efficient handling.

Circle Item 109 on postcard, page 195



Warco press of 300-ton capacity announced by Federal Machine & Welder Co.

Warco Four-Point Eccentric Gear Press

A welded steel, double-back-geared, four-point eccentric gear press has been designed by the Warco Press Division of the Federal Machine & Welder Co., Warren, Ohio, for a leading aircraft manufacturer. This press, especially designed for maximum rigidity and strength in frame and drive, has a capacity of 300 tons when the ram is 1/2 inch from the bottom of its stroke.

The frame is of the steel tie-rod type and the distance between gibs is 137 inches. The slide has an area 90 by 136 inches and a stroke of 18 inches. The press op-

erates at 14 strokes per minute, is equipped with a Warco pneumatic clutch and brake with electrical clutch control, requires a floor space approximately 96 by 190 inches, and weighs approximately 192,000 pounds.

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Harvey Butterfly Hand Feed Surface Grinder

The Harvey Mfg. Co., Long Island City, N. Y., has just added an 8- by 12-inch precision hand feed surface grinder to its line of metal-working machines. This grinder is designed to handle large, fine-tolerance grinding as well as very small intricate work. An outstanding feature is the transverse slide which travels on double vee ways and has a maximum capacity of 9 inches.

A specially constructed 1/2-hp motor is used to drive the dynamically balanced spindle, which was designed to assure true smooth running at high speeds. Permanently lubricated over-size super precision ball bearings are spring-loaded for take up on wear and heat expansion. Needle bearings are used throughout the machine and all ways are ground, lapped, and hand spotted. This machine is also available with hydraulically operated longitudinal table travel. The maximum capacity is 9 by 13 by 11 1/2 inches.

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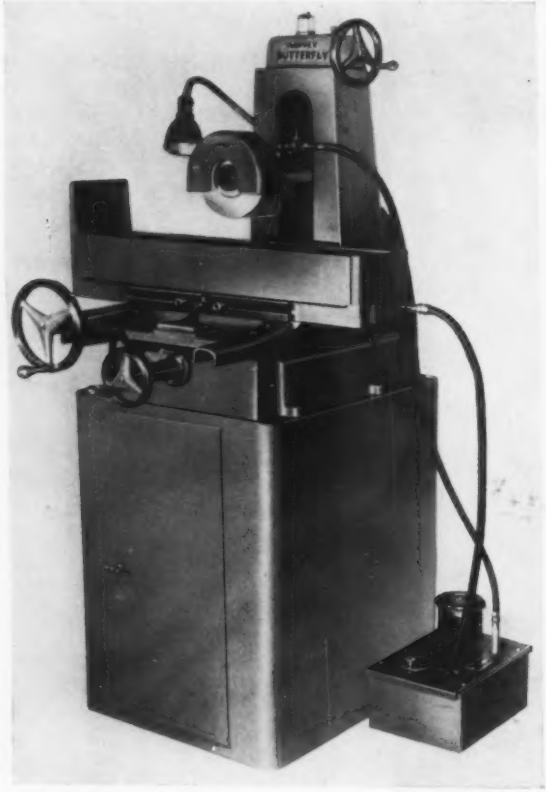
High-Speed Bench Press

Forming, trimming, and force-fit assembly operations can be performed on a new high-speed bench press announced by the Hannifin Co., Des Plaines, Ill., a division of the Parker-Hannifin Corporation. Dual hand control and adjustable down-stroke control are standard on this press, and electric push-button controls with or without pressure reversal are available as optional features. Return stroke is adjustable in all models. This permits shortening of the work cycle to the point where the ram just clears the work-piece on repetitive operations.

The press is 39 inches high above the bench or other surface on which it is used—on a 17- by 30-inch baseplate. (A matching steel base is available for floor mounting.) The stroke is 6 inches; reach from throat of frame to center line of ram, 6 inches; and gap (or "daylight"), 12 inches. The removable table is 14 1/2 inches wide by 10 inches deep, and its top is 8 1/4 inches above the mounting surface. The 4-ton model has the following speeds: down, advance, 700; down, feed, 330; and return, 670 inches per minute. A 2-ton model with the same frame is also available.

These new models with high ram speeds and adjustable down-stroke control are expected to extend the advantages of hydraulic press trimming to shops producing small die-castings.

Circle Item 112 on postcard, page 195



Butterfly surface grinder built by the Harvey Mfg. Co.

Hannifin high-speed bench press with dual hand control

Machine for Marking Metal Parts

The Noble & Westbrook Mfg. Co., East Hartford, Conn., has announced a high-speed automatic roll type marking machine designated Model 490. This machine is shown tooled for trademarking padlocks after they are completely assembled. Due to the thin wall at the marking area, it was necessary to roll mark gradually under very low pressure with multiple passes of a roll die. In order to achieve the required production rate, an extremely high-speed motorized reciprocating die slide was required.

In operation, the die slide reciprocates continuously at approximately 400 strokes per minute. After each index of the work-table, the table slide of the machine rises to bring the work into contact with the roll die, applying pressure as pre-set by the pressure regulator. After a predetermined time interval, allowing for a specific number of roll passes, the table slide drops and the work-table is again indexed.

The machine has two air control units, one for the work-table and the other for the index-table. Both units include filter, pressure regulator, gage, and lubricator. Both air cylinders are equipped with speed control valves, and a dual-control circuit is provided to operate all components independently for setup purposes. An emergency stop is also included.

With this machine, depth of mark is achieved by varying marking pressure and number of marking strokes. The more delicate or fragile the part, the lower the marking pressure, and the greater the number of marking passes required. Both marking pressure and the number of roll-marking passes are infinitely variable.

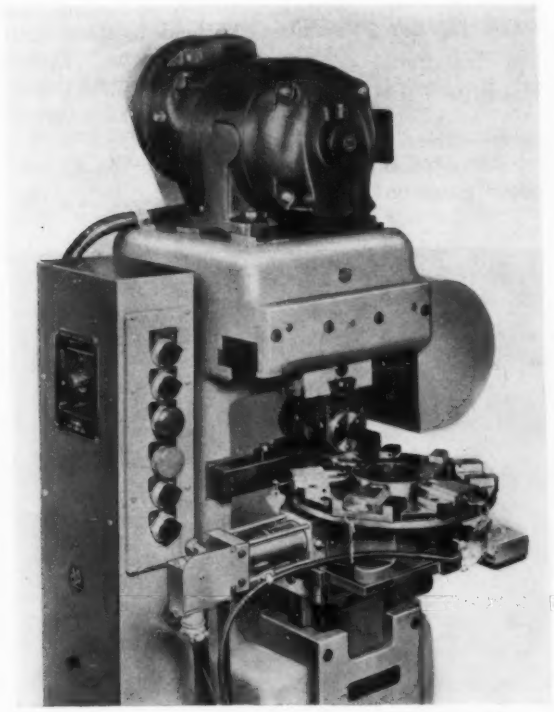
Circle Item 113 on postcard, page 195

Chain-Driven Dial Feed Presses

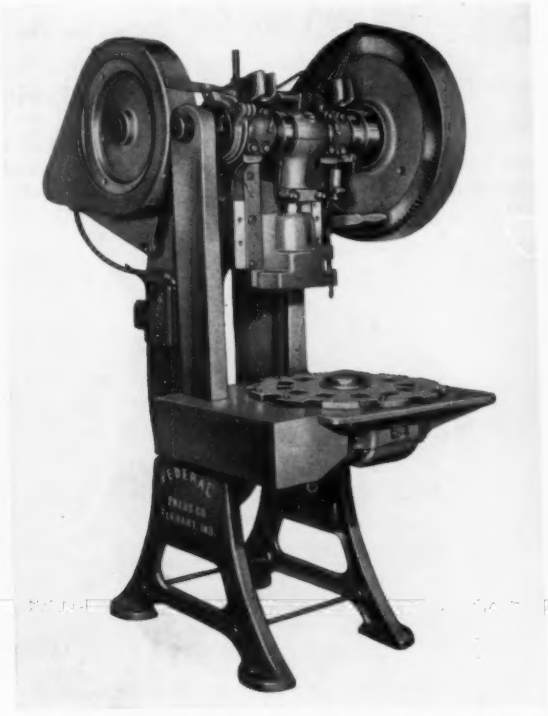
The Federal Press Co., Elkhart, Ind., has just introduced a series of new chain-driven dial feed presses designed to extend the utility range of their line of dial feed mechanical presses and provide for the safe operation of these machines. The principal change in design involves the method of driving the indexing cam by a center-guided, silent automotive type timing chain rather than by shaft and miter gears, as in the preceding line. The chain drive is said to provide 50 per cent more work area for the operator, and permit the handling of certain types of work heretofore precluded. The chain is guarded.

The new dial feed index rollers are essentially cam followers, sealed for lifetime lubrication. The cam housing is sealed with O-rings to prevent oil leakage. Both the index-plate and the work-plate operate on ball thrust bearings. The shot-pin, located on the left under side of the work-plate, is equipped with a tapered bushing to assure positive location at each index position. The work-plate itself ordinarily moves clockwise.

The square design of the dial base provides an apron for the convenience of the operator. The width of the apron may be increased to provide for the installation of hopper feeds. Other



Noble & Westbrook automatic metal-marking machine



Federal press equipped with new chain-driven dial feed

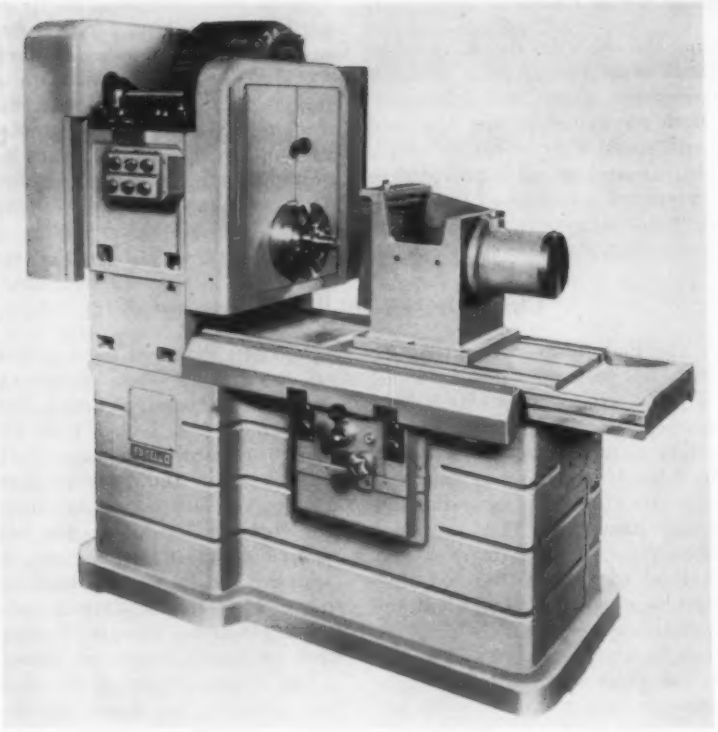


Fig. 1. Ex-Cell-O boring machine equipped for eccentric boring and turning

features include over-sized crankshafts, Timken bearings, solid web type flywheels, symmetrical rams, and longer gibs and V-ways. The new presses will be built in eight sizes with capacities ranging from 6 to 80 tons.

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Ex-Cell-O Two-Spindle Precision Boring Machine

A Style 112-D precision boring machine equipped with two spindles in a single body, but running independently of and eccentrically to each other, is holding close tolerances with a good finish on cast-iron oil-pump bodies for automatic transmissions. This machine, Fig. 1, is built by the Ex-Cell-O Corporation, Detroit, Mich. An oustanding feature of the machine is the special tool setting gages which permit quick, accurate tool changing as well as increased production.

Positioned on a foolproof pin, the part, Fig. 2, is located peripherally from its outside diameter and by a radial locating pin. A hydraulically operated fixture jack backs up the part during the machine cycle. Utilizing two independently operating boring spindles, one turning within and eccentric to the other, the part is bored and turned to produce concentric and eccentric diameters, and plunge-faced in two pockets. Specifically, the outer spindle, equipped with a special cutterhead carrying two tools, bores and turns two concentric diameters and plunge-faces one pocket surface. The inner spindle, also carrying two tools, bores an arc and a bushed hole eccentric with the outer surfaces. At the end of the boring stroke, another pocket surface is plunge-faced and blended with the plane of the first. Eccentricity of the machine diameters is held to 0.300 inch plus or minus 0.005 inch. Pocket faces are held square with the diameters to 0.0005 inch per inch of runout. The net production rate is fifty-one pieces per hour.

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Fig. 2. Cast-iron oil-pump body for automatic transmission with accurately blended pocket faces machined with two-spindle tool shown in Fig. 3

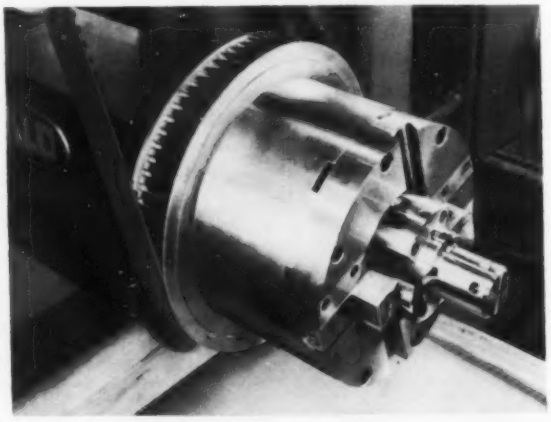
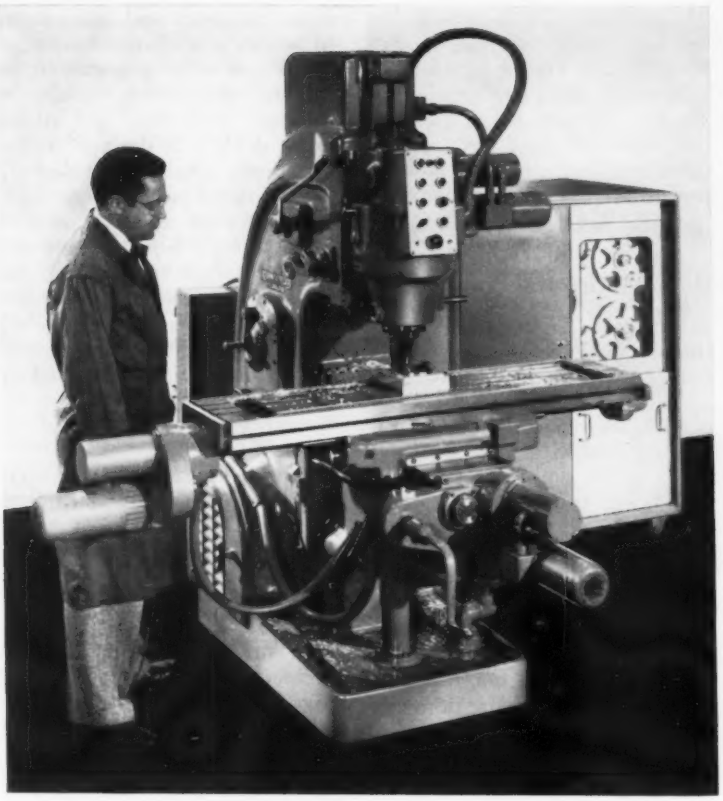


Fig. 3. Close-up showing spindle within a spindle for boring concentric and eccentric diameters and plunge-facing pockets of part shown in Fig. 2



Knee type milling machine equipped with Digimatic control system

Kearney & Trecker Numerically Controlled Knee Type Milling Machines

Three standard knee type vertical milling machines specifically designed for three-dimension milling of small and medium-sized work-pieces of both ferrous and non-ferrous metals are now available, equipped for numerically controlled operation from the Kearney & Trecker Corporation, Milwaukee, Wis. The three models are the 5-hp Model 2CH-KTNC, with sixteen spindle speeds ranging from 25 to 1500 rpm, shown in the accompanying illustration; and two heavy-duty 15-hp models designated the 315TF-KTNC and the 415TF-KTNC, each with twin elevating screws and twenty-four spindle speeds ranging from 15 to 1500 rpm.

Power for short feed motions is transmitted through low-friction, recirculating ball screws for high efficiency, long life, and accuracy. The three control systems available are the Bendix, GE, and ECS—Digimatic. Proper selection of a particular control system will be determined by the job to be done, the price, and the computor facilities available. Any one of the systems can be applied to any of the three machine models. Tape preparation is available from Kearney & Trecker and from each of the system's manufacturers.

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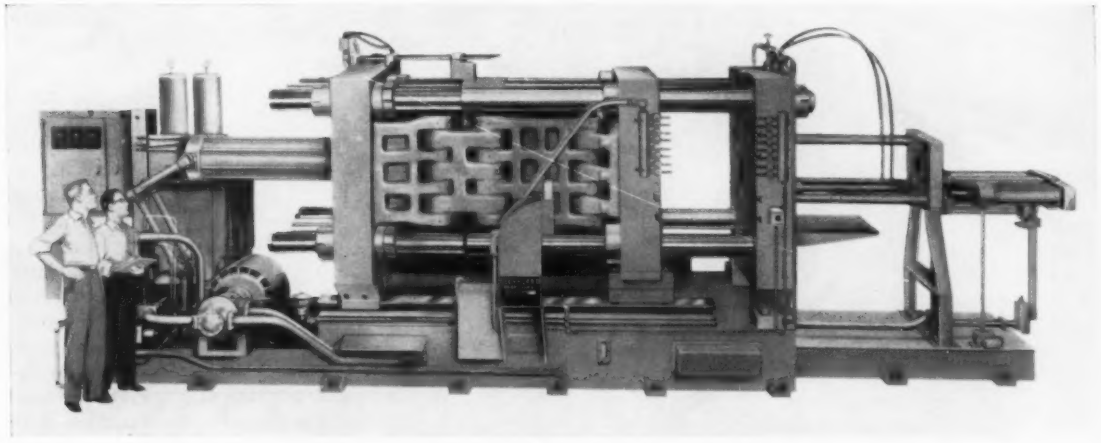
Cleveland Hydraulic Die-Casting Machine

A 1000-ton hydraulic die-casting machine designed for the rapid production of large aluminum die-castings of the highest quality has been brought out by the Cleveland Automatic Machine Co., Cincinnati, Ohio. This machine has many advanced engineering features and is capable of fast, smooth around-the-clock production of aluminum die-castings weighing up to 25 pounds.

Engineering features include: heavy, fabricated one-piece base; automatic lubrication; manifold hydraulics; leak proof piping; 40-



Hydraulic die-casting machine for aluminum brought out by Cleveland Automatic Machine Co.

hp motor; two large capacity hydraulic pumps; 230-gallon hydraulic reservoir; and automatic timing remote control panel.

The die-locking pressure, (strain gage tested) is 1000 tons; the dieplates are 67 by 67 inches; maximum die thickness, 45 inches; and minimum die thickness, 24 inches. The die opening is 20 to 30 inches and the space between tie bars, 42 by 42 inches. The plunger can be adjusted to attain any speed up to 480 feet per minute. At any predetermined plunger position, the intensifier can generate plunger pressures up to 26,000 pounds psi.

Circle Item 117 on postcard, page 195

Nilson Vertical Four-Slide Forming Machine

The A. H. Nilson Machine Co., Shelton, Conn., has announced the development of a vertical four-slide forming machine designated the V-187 "Vertiform." This machine is basically an automatic four-slide machine with the forming done in a vertical rather than a horizontal plane. Departing from conventional means of actuating the forming slides, the design incorporates a drive-shaft located behind the face of the machine. Forming slide rolls have needle bearings and are placed in the center of the slides to give a centralized thrust from low-angle barrel cams mounted rigidly in the frame to completely eliminate shaft spring. With this design, "lift up" and "twisting" action is reduced to a minimum.

One advantage claimed for the vertical arrangement is that the finished product is ejected to the front and is not limited in size by having to pass through an opening of fixed size in the bed. Since the machine lends itself to discharging work onto rails, it is readily adaptable to automation processes. Other advantages claimed for the Vertiform include easy access tooling; unobstructed view of product being formed; form bracket rigidly mounted in bed; maximum safety—most moving parts enclosed; minimum floor space required; and adaptability to hopper or magazine feeding.

This versatile, general-purpose forming machine is capable of handling both wire and ribbon metal stock. It is designed to automatically produce a wide variety of formed parts to close tolerances at high speeds. Metal is taken directly from the coil and is straightened, fed, cut off, and formed, eliminating secondary handlings. When threading, hollow-milling or chamfering are part of the work required in making a complete wire part, these operations can be included in the forming process.

The machine handles wire up to 0.187 inch in diameter and ribbon metal stock up to 1 1/4 inches wide. Maximum length of the standard feed is 15 inches. Standard equipment includes built-in form moving attachment, roll type stock straightener, automatic lubricating system, variable-speed drive, handbar safety switch, manual electric starter, and fluorescent lighting over tooling area.

Accessory equipment includes wire and stock reels and press attachments. A Nilson 4-ton or 20-ton press attachment mounted vertically on the face of the machine will greatly increase its capacity. Both press attachments feature the use of standard removable die sets.

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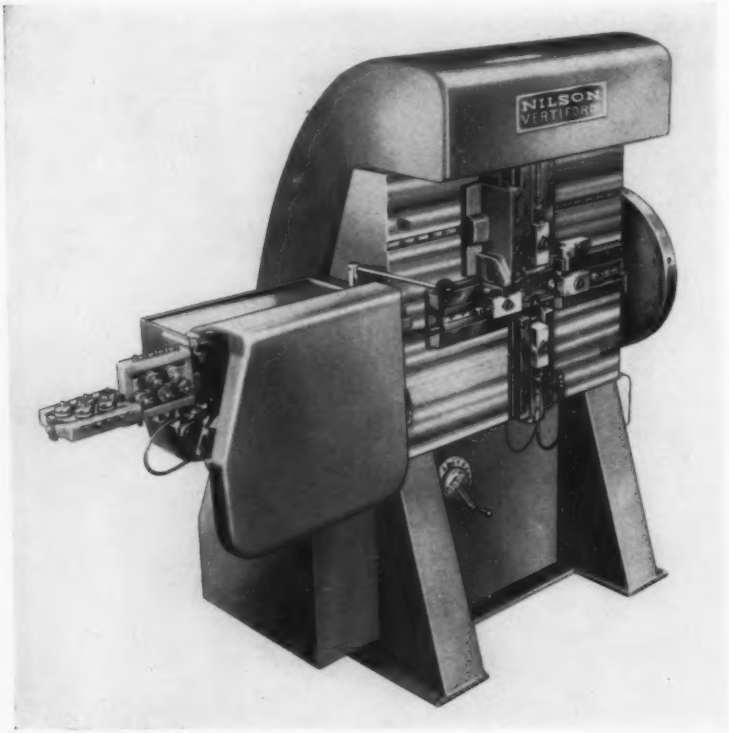
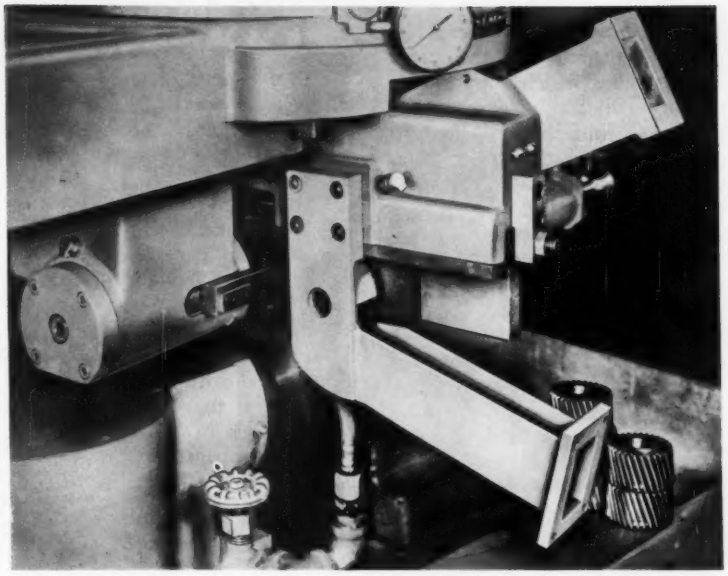


Vertical four-slide forming machine announced by A. H. Nilson Machine Co.

Loading and Unloading Device for Michigan Gear-Finishing Machines

Availability of an automatic loading and ejecting device for its full line of universal rotary gear-finishing machines is announced by the Michigan Tool Co., Detroit, Mich. The device, designed for automated lines, can be ordered as original machine equipment or as a modification unit for any 870-series machine in use.

Simplicity, speed, and positive positioning are features of the loading device. With gears automatically fed from a demand type, parts-distribution system, the device permits one operator to handle a battery of machines with ease. Loading, shaving, and unloading are entirely automatic.



Close-up of automatic loading device for Michigan Tool Co.'s 870-series gear-finishing machines. The loading slide of the unit feeds one gear at a time to the position where it is picked up by air-operated centers

The loading unit, although custom tailored to the application, is standardized for gears up to approximately 4 inches in diameter. As an optional feature, the unit can be equipped with gaging gears (a work-sizing feature) at the entry end of the feed chute. The gaging gears prevent oversize parts, that require excessive stock removal, from entering the loading slide.

The machine operates in automatic cycle—loading, finishing, and ejecting—until the parts supply is exhausted, when it automatically stops. A pre-set counter available as optional equipment can be set to turn on a signal light indicating when any desired number of gears have been finished and when the shaving cutter should be checked to determine the need of sharpening.

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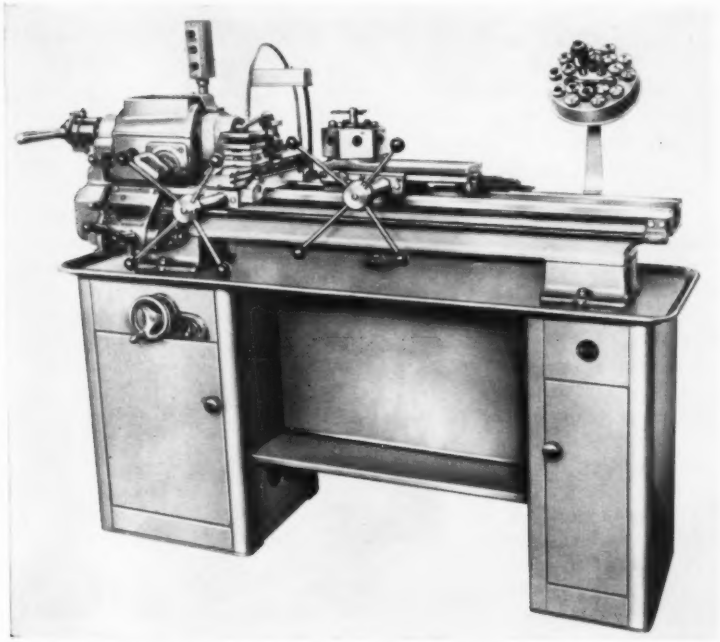
Rockwell-Delta Metalworking Lathe

A double toolpost cross-slide with pilot wheel feed is one of a new line of accessories designed to broaden the applications of standard Delta 11-inch metalworking lathes made by the Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. The new cross-slide, already incorporated in the recently introduced Delta hand screw machine, is now available for installation on Delta lathes in the field. When used with a Delta bed turret, it converts an 11-inch engine lathe into a six-station turret lathe or hand screw machine for repetitive, high-production manufacturing of a wide variety of parts ranging from simple washers and shafts to intricate parts used in the electronics and aircraft industries.



Delta metalworking lathe with newly developed accessories announced by the Delta Power Tool Division, Rockwell Mfg. Co.

The unique pilot wheel feed provides an unusually rapid slide movement with a full 8-inch travel. Universal tool positioning is made possible by the new slide. T-slots in the toolpost pads and slide provide for transverse and longitudinal adjustment without disturbing the saddle on the bed. The hardened steel toolposts have left and right tool positions.

Stops for slide travel have rapid coarse and fine micrometer adjustments. Slide, saddle, and toolpost pads are precision ground and two gibs are provided for accurate slide adjustment and wear compensation. The regular turret toolpost on Delta lathes now in the field can be used on the new cross-slide by means of an inexpensive adapter.

Another new accessory for use with the 11-inch lathes is a lever

type, ball-bearing collet closer, in which a large ball bearing has been substituted for the plain bearing shoes which support the ordinary collet tube at the outboard end. An adjustment feature guarantees that the collet tube will run concentric with the spindle of the headstock and be free of whipping or vibration.

A two-piece guard for the outboard gear train is a new safety device recommended for lathes on which a lever-type collet closer is used. This guard permits easy access to the gear train without removal of the collet closer. A new splash guard is available for use when coolant is employed.

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"Infispeed" Sliding-Head Drilling Machines

Infinitely variable spindle speed within the speed range of the machine is provided in the new Infispeed sliding-head drillls announced by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. With this new control, the exact speed required to suit the drill diameter and work material may be obtained. Changing of speeds can be accomplished in seconds. All controls are conveniently located at the front of the machine.

Infispeed drilling machines are available in four sizes. Medium-duty models in 16- and 24-inch sizes have a 1-inch drilling capacity in cast iron. They are built in single- and multiple-spindle, floor, bench, and production box column models. The heavy-duty machines with 1 1/2-inch drilling capacity are built in 21- and 25-inch sizes, box and round column, single- and multiple-spindle floor models.

Speed selection is accomplished through a variable speed pulley. On medium-duty models, the engaging diameter of the pulley is varied by a hand wheel on the face of the drill head. On the heavy-duty machines, it is varied by a fractional-horsepower motor controlled by a "slow-fast" turn-button switch. The 21- and 25-

Fig. 1. Medium-duty Cincinnati Infispeed sliding-head drilling machine built in 16- and 24-inch sizes with 1-inch drilling capacity in cast iron

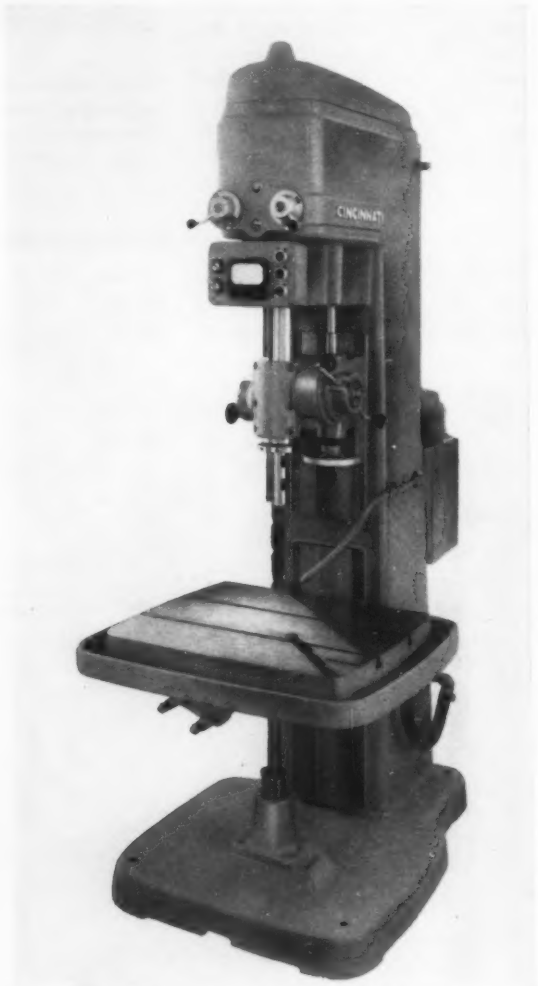
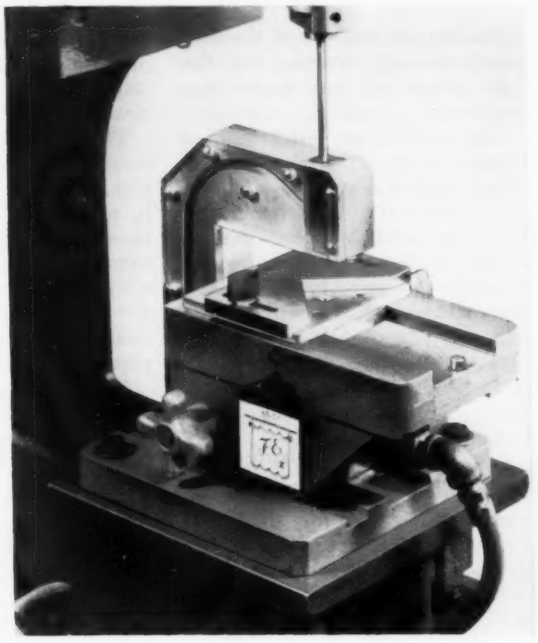


Fig. 2. Cincinnati Infispeed 25-inch sliding-head drilling machine with 1 1/2-inch drilling capacity in cast iron. Also built in a heavy-duty 21-inch size

Precision motorized center unit developed by the AA Gage Co. for use on surface grinders



"Ball-O-Matic" fixture brought out by Industrial Tectonics, Inc., for use in sizing and finishing holes

inch sizes also have a back-geared drive to provide maximum torque in both high- and low-speed ranges. All Infispeed models have a tachometer mounted on the head to aid accurate speed selection.

Infispeed medium-duty, 16- and 24-inch size drills afford a spindle speed range from 450 to 3000 rpm with the standard 1800 rpm, 1-hp motor. The 21- and 25-inch, heavy-duty Infispeeds provide 60- to 1825-rpm spindle speeds with the standard 1800-rpm, 3-hp motor. Power feed with five feed rates from 0.002 to 0.015 inch is standard equipment on the heavy-duty drills. Power feed is optional on the medium-duty models. A positive stop is provided on all Infispeed drills.

Circle Item 121 on postcard, page 195

Work-Holding Centers for Use on Surface Grinders

A motorized work-holding center unit that makes possible concentricity and squareness accuracies of 50-millionths inch has been announced by the AA Gage Co., Detroit, Mich. Originally developed for the production of the manufacturer's line of cylinder squares, the device is now being offered for application in toolrooms and specialty shops. Jobs not normally handled on a surface grinder can be set up easily and ground accurately when the motorized center unit is used.

The live center is mounted in a precision ball bearing and is driven by a 1/4-hp motor through a speed reducer. The center speed is 78 rpm. By using a heavy-duty powerstat attachment, the speed can be varied to achieve exact grinding speeds for different materials and diameters.

Either a high-speed steel or a carbide dead center is held in a movable slide. Approximate center distance is obtained by moving the slide and locking it with a T-bolt. Fine adjustment of the dead-center position is then made by a rack and pinion after the work-piece is inserted. The unit has a stabilized cast-iron frame.

Standard centers accommodate work-pieces from 1 to 10 inches long and units for greater lengths can be obtained on special order. The maximum work-piece diameter is 7 inches. The complete unit, including motor, weighs 55 pounds.

Circle Item 122 on postcard, page 195

"Ball-O-Matic" Ballizing Fixture

A "Ball - O - Matic" universal work-holding fixture for use in sizing and finishing holes by the ballizing process has been announced by Industrial Tectonics, Inc., Ann Arbor, Mich. This process consists of pressing a ball of suitable size and hardness through the unfinished hole to obtain high precision and fine finish at exceptionally low cost. The Ball-O-Matic fixture accommodates a wide range of parts for ballizing holes of 1/16 to 1/2 inch in diameter. It can be used on an arbor press, drill press, vertical broach, or any other equipment having a vertical ram that will hold a push-rod. The work is held in (or on) an anvil, which can be pulled forward for loading and pushed back against a positive stop to position the work for ballizing.

After a hole is ballized, the ball is returned to the top of the fixture by an air jet, along an internal track. The track is visible through a plastic side piece, and the ball is readily removed for inspection or replacement. By tying in the air-jet valve with the ram control, ball return is made automatic. When the ram moves down

to ballize the next piece, the ball is automatically dropped into the hole ahead of the descending push-rod.

The ball-release mechanism is contained in a vertical block, which also guides and supports the push-rod. Interchangeable blocks are available for push-rods of various diameters and are adjustable vertically to give minimum clearance between the block and the top of the work. This prevents the ball from escaping and provides good support for the push-rod. Preliminary vertical adjustment is obtained by means of interchangeable spacer blocks beneath the anvil.

The V-shaped anvil shown takes parts up to 3 inches in diameter by 1 5/8 inches high. It can be replaced by an anvil blank that can be drilled or countersunk to suit specific parts, or an anvil with a lever-operated jaw that prevents distortion of slotted holes during ballizing. All parts are quickly replaceable for change-over.

Circle Item 123 on postcard, page 195

Lincoln Submerged-Arc Welding Machine

A new type of mechanized welding machine for the submerged-arc process announced by the Lincoln Electric Co., Cleveland, Ohio, promises to extend the advantages of this high-speed, low-cost, uniformly excellent quality welding process to many jobs for which it could not previously be used. The new machine, Fig. 1, designated as the Lincolnweld ML-3, is a mechanized unit which provides automatic wire feed, flux flow, and travel speed, but permits manual guiding of the welding arc, as shown in Fig. 2.

The unit feeds a continuous wire electrode from a coil to the compact, hand-held gun which is held against the joint along which it is propelled at a pre-set speed by a small motor. A low-pressure air system flows flux from a large tank to the gun from which it drops to completely cover the arc at all times, yet does not flow ahead of the arc to obscure the seam.

The features of the new machine are intended to improve the application of the submerged-arc process, extending its use and reducing the cost of many jobs now being welded by hand with conventional coated electrodes. Speeds up to 70 inches per minute using up to 600 amperes are possible with this manual, mechanized unit. It can be used on materials ranging in thickness from 10 gage up.

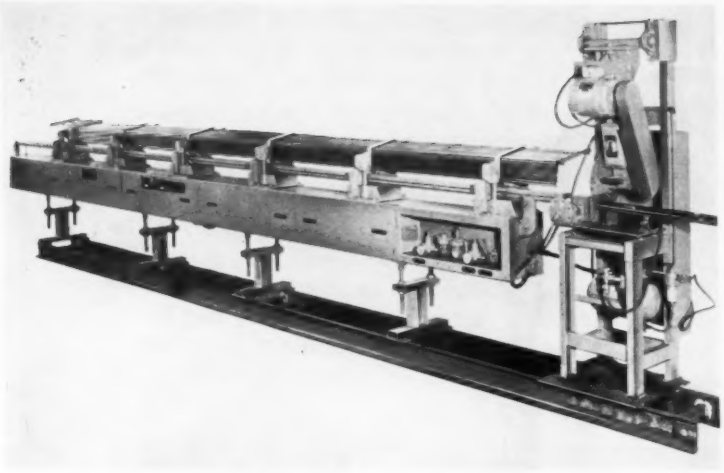
Circle Item 124 on postcard, page 195

Cut-Off Machine with Automatic Feed

An automatically fed, swing type cut-off machine, with which it is possible to store the material and have it automatically fed to a stop and clamped for the cutting-off operation, is announced by the Wallace Supplies Mfg. Co., Chicago, Ill. Clamping is done by air pressure as the operator swings the cutting head into cutting position.

The setup shown is used to cut tubing with an outside diameter of 5/8 inch, a wall thickness of 0.062 inch, and length of 22 3/4 inches. The actual floor-to-floor time is 2.4 seconds per piece for ten pieces. The re-load time between bars is 7 to 10 seconds. The machine has a capacity for cutting round tubes or pipes up to 1.900 inches in diameter. A 12- or 14-

Fig. 1. (Left) Mechanized submerged-arc welding machine made by Lincoln Electric Co. Fig. 2. (Right) Welding gun of machine shown in Fig. 1, guided by hand in making fillet weld



Wallace automatically fed, swing cut-off machine with provision for material storage

inch wheel can be used. Ferrous materials can be cut with abrasives, or non-ferrous materials can be cut with a metal wheel using a mist coolant system.

Circle Item 125 on postcard, page 195

Continuous Wheelabrator Tumblast

A 26-inch continuous Tumblast with end work discharge is the latest addition to the line of continuous tumbling type blast cleaning machines manufactured by the Wheelabrator Corporation, Mishawaka, Ind. This machine is designed to handle a continuous flow of miscellaneous work at a high production rate. The blast cleaning is completely automatic and continuous. Work entering the machine at one end passes directly into the cleaning chamber; it then slides down an inclined chute into the discharge drum and is dropped from there into a tote box or conveyor.

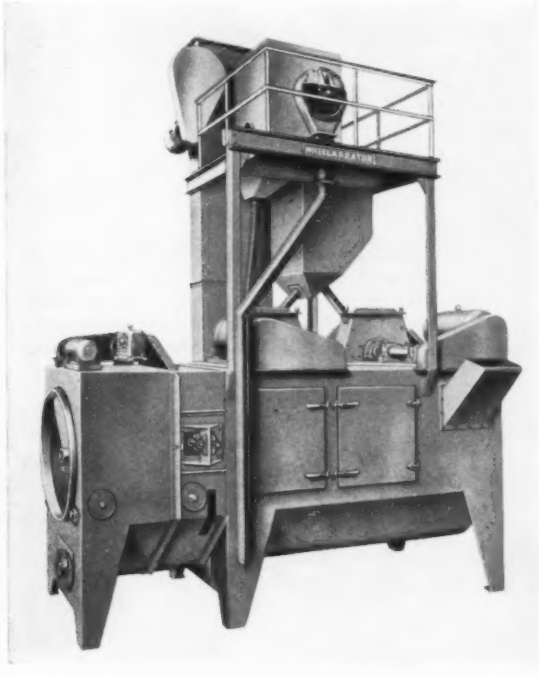
The unique combination of tumbling and longitudinal travel uniformly exposes all surfaces of every part to the abrasive blast of the overhead Wheelabrator unit or units. As a result, even the most intricate pieces are said to be thoroughly cleaned at a production speed geared to any need. This continuous Tumblast line includes 15-, 36-, 48- and 60-inch sizes.

Circle Item 126 on postcard, page 195

Electrically Controlled Gravity Drop-Hammer

An electrically controlled gravity drop-hammer of entirely new design has been developed by the Chambersburg Engineering Co., Chambersburg, Pa. This machine is especially designed for precision blow control and the use of automatic feeding devices. It per-

(Continued on page 192)



Continuous Tumblast added to Wheelabrator line

Chambersburg gravity drop-hammer

How Earl Singleton cut the cost of

With 28 years experience in the abrasives industry, Bay State distributor Earl Singleton figures that one improvement in a grinding operation ought to lead the way to another. And, judging by the results he's produced, he's 100% right

This is a good example of what happens when you tell a Bay State distributor your problem and give him a chance to experiment.

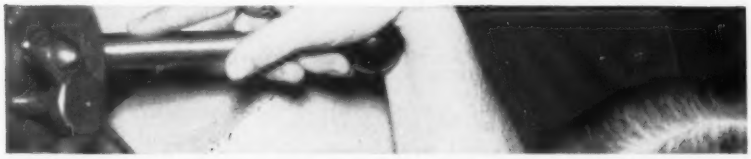
The problem: Grinding teeth on heavy traction gears for diesel locomotives at the Indianapolis plant of a large manufacturer of components for diesel locomotives.

The man: Earl Singleton, Abrasive Engineer at Browning Tool & Supply Co., Indianapolis.

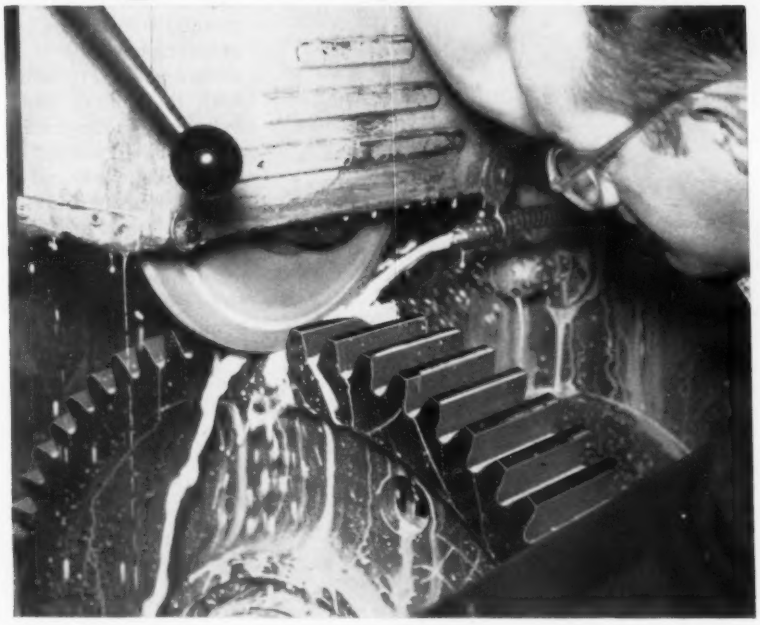
Working with the foreman of the department, Singleton came up with a 14" grinding wheel that cost 14% less than the premium-priced wheel it replaced. It held form better, too, and so didn't need to be dressed as often.

That was fine. But Singleton figured they might also get more pieces per wheel if they used a slightly larger wheel. After exhaustive tests to ensure complete safety, a 15" wheel was put to work and wheel life was more than doubled . . . from 16-17 pieces to 35-36. Down-time was reduced, too.

Even if you seem to have no particular grinding problems at the moment, it's worth while getting acquainted with the Bay State distributor in your area. Like Earl Singleton, he may find ways to save you money that haven't occurred to the people in your shop. *Better grinding at lower cost – that is his business.*



grinding heavy traction gears



Bay State specification cut wheel cost 14% . . . *and* wheel held form so well that wheel life was doubled under regular production conditions.

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

forms such operations as forming, embossing, coining, and re-striking in a single die impression.

Precise blow control is achieved by maintaining close pressure tolerances on the air supply and by the fine adjustment of a regulating valve on the hammer's exhaust air system. The electrical control permits synchronization of feeding mechanisms and the installation of "no stock—no blow" safety devices to protect the dies. When the feeds are used in combination with sorting and orienting equipment, completely automatic operation is achieved. The machine can be arranged for standard treadle operation when it is fed manually.

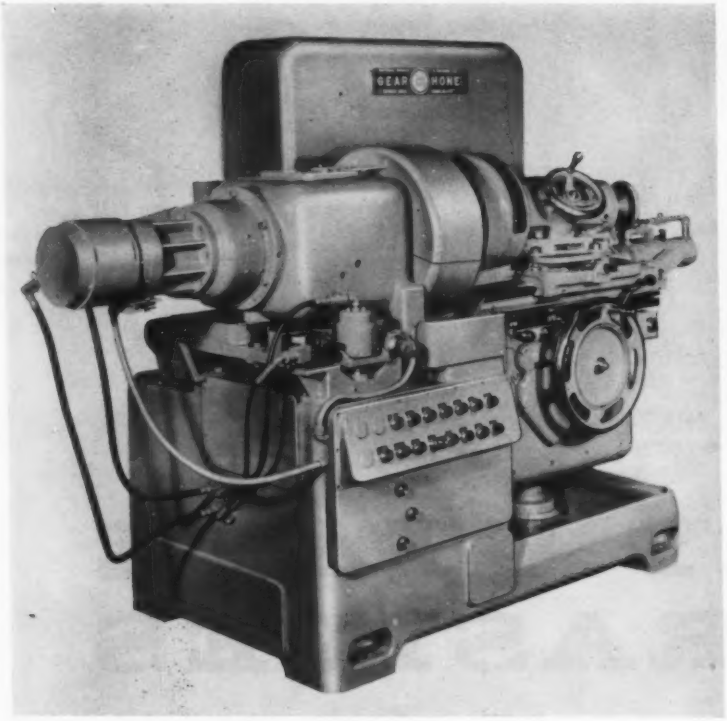
Air is used only when the hammer is in operation, resulting in great economy. Rigid construction assures accurate die alignment. A wide range of blow intensities can be obtained by making a few simple adjustments. A safety rest supports the ram while dies are being changed and adjusted.

Circle Item 127 on postcard, page 195

Red Ring Gear Tooth Honing Machine with Motorized Work-Head

A Red Ring internal gear tooth honing machine designed for finishing operations on hardened spur and helical internal gears is now available from National Broach & Machine Co., Detroit, Mich. This new Model GHC machine is designed to remove nicks and burrs, improve tooth surface finish, and make minor tooth-shape corrections in hardened gears. Both taper and crown honing operations can be performed.

The machine has a special high-speed motorized work-head with a patented tilting arrangement that permits honing with either constant-pressure or zero-backlash methods. The abrasive-impregnated, gear-shaped, plastic honing tool, which is driven by the work gear, is mounted in crossed axes relationship on a spindle head that is reciprocated by a slide during the honing operation. A handwheel at the front of the machine adjusts the honing head to the correct center distance position.



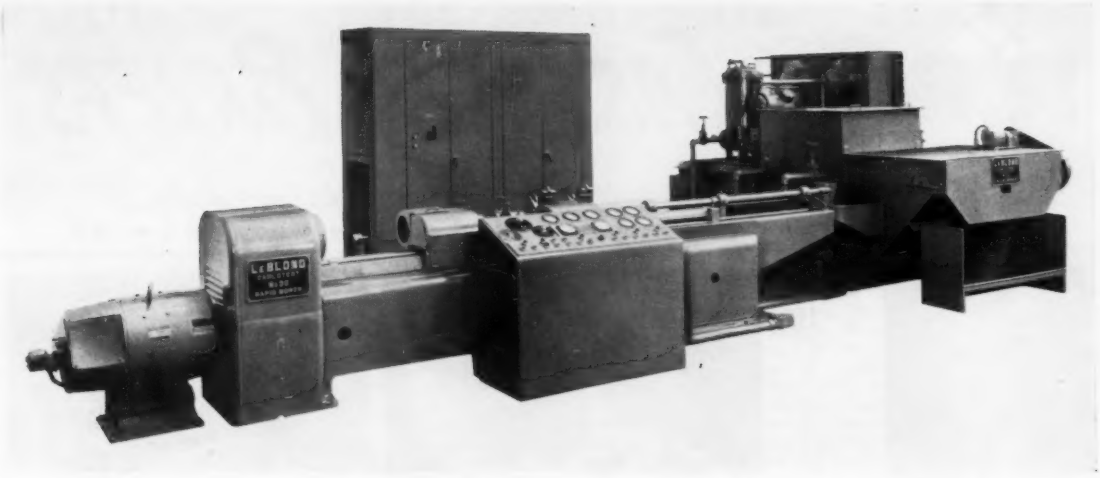
Red Ring gear tooth honing machine for hard gear finishing operations on internal spur and helical gears

The zero-backlash method is used for removing nicks and burrs, making minor tooth-shape correction, and improving surface finish of gear teeth made within commercial tolerance specifications. With this method, an air cylinder tilts the work into a controlled tight mesh loading with the hone. Another air cylinder locks the gear in this fixed center-distance position for the honing cycle. The air cylinder lock is released at the end of the cycle and the main air cylinder tilts the work-head up for unloading and loading of the work gear.

The constant-pressure method is used to hone teeth on gears produced to dimensions outside commercial tolerance ranges. In this arrangement, the work is tilted into controlled tight-mesh contact with the honing tool by the air cylinder. The cylinder maintains a controlled constant pressure between the work and tool during the honing operation. The work-head is tilted up and the hone slide is retracted automatically for removal of the gear at the end of the push-button-controlled honing cycle. The work-head can be angularly adjusted to fixed positions in the horizontal plane to provide for taper honing operations.

The machine will hone gears with pitch diameters of from 4 to 6 inches. Electrical and pneumatic controls are housed in separate panel enclosures at the rear of the machine. The work-head is driven by a 2-hp motor, and the hone head is reciprocated by a 1/2-hp motor. An air cylinder advances and retracts the honing head for loading clearance. Push-button controls are provided for the set-up, method selection, and automatic cycle operation. A diaphragm type, air cylinder-operated chuck is used to mount the work gear in the machine illustrated. This machine occupies a floor space approximately 63 by 40 inches and is 64 inches high.

Circle Item 128 on postcard, page 195



Rapid borer adapted for wide range of work manufactured by the R. K. LeBlond Machine Tool Co.

LeBlond-Carlstedt Rapid Borer

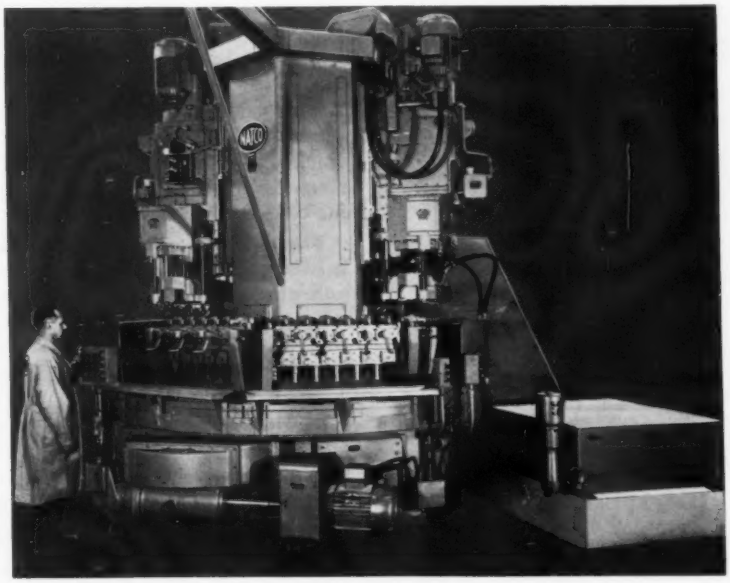
A LeBlond-Carlstedt rapid borer designed to solid-bore, trepan, or counterbore long holes at exceptionally fast rates is being manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. This machine will bore holes from 5/16 inch to 4 1/4 inches in diameter in a large range of work sizes. In general, it is suited to round, square, octagonal, tapered, or stepped work that is, or can be made, symmetrical for rotational balance.

The borer was developed expressly to accommodate revolutionary new tooling which cuts at very high speed with excellent accuracy and finish. Cutting oil is forced between the boring-bar and hole wall, forming a continuous bearing. The oil flushes back through a hole in the boring head and bar, carrying away the chips as it goes. Chip form is controlled both by tool angles and the proper combination of feed and speed. This serves to keep the tool faces clean and chip passage clear. The cutter is designed to produce balanced cutting pressures, thereby controlling concentricity.

Circle Item 129 on postcard, page 195

Center-Column Machine for Processing Connecting-Rods

Approximately 435 forged-steel connecting-rods are processed per hour on two center-column machines built by the National Automatic Tool Co., Inc., Richmond, Ind., for a large manufacturer of truck engines. The 100-inch diameter, six-position center-column machines work in series and are arranged to hold six parts in each position.



Center-column machine built by National Automatic Tool Co.

In the first machine, the piston-pin holes are drilled, core-drilled, chamfered from both sides, and reamed to a final diameter of 1.0475 inch. Processed parts are unloaded and unprocessed parts loaded in position No. 1. In position No. 2 the piston-pin holes are drilled halfway through, and in position No. 3 they are drilled through. In position No. 4 the same holes are core-drilled for reaming. In position No. 5 both the top and the bottom sides of the holes are chamfered, using a special tool for this operation. In position No. 6 the piston-pin holes are reamed to a diameter of 1.0475 inch, allowing sufficient stock for final boring and honing.

After the piston-pin holes have

(Continued on page 200)

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Select proper bolt diameter

An erroneous rule of thumb worth forgetting is that no bolt under ⅝" should be used where fastened members are under stress. Yet bolts ½-inch and smaller take plenty of external loading.

HOW TO LOOK AT IT

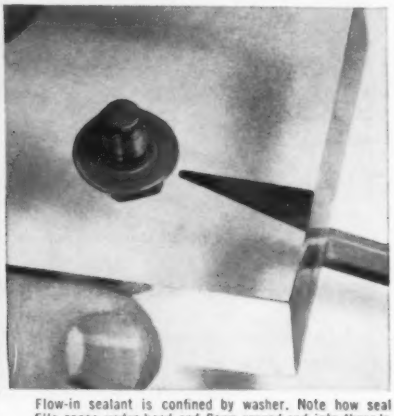
Primarily, you have to satisfy the stress requirements . . . the load. So select bolts on that same basis: the actual strength to sustain that load.

Calculating the strength requirements will tell you what bolt tensile, size, and number you need. If smaller bolts suffice, use them to avoid the penalty of overdesign. Holes can be smaller which means faster drilling and tapping. You have a chance to save materials since with smaller bolt holes, fastened members can often be made smaller too. You may also be able to standardize on a single size, saving assembly-line time.

SIZE VS. SAFETY

Remember that for a given grade of material, size tells you *capacity* of a bolt, not its *safety*. If you *tighten* a bolt to capacity, then you get safety. That's why a smaller bolt properly tightened is better and safer than a larger bolt sloppily tightened, especially where the loads are dynamic. Obviously, you reduce risk of under-torqued bolts as you reduce their size.

The new RB&W "SPIN SEAL" fasteners have spring-type washer with adhering flow-in seal . . . pre-assembled to standard machine or tapping screw.



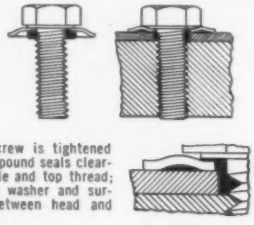
Flow-in sealant is confined by washer. Note how seal fills space under head and flows around and into threads in tightened SPIN-SEAL screw.

New SPIN-SEAL* screws give leakproof fastening

Here is a new type of composite fastener that seals by means of a unique flow-in sealant and washer.

ASSURES TRIPLE SEAL

Concave in shape, the heat treated springy washer confines and controls the flow of sealing compound. Tightening the screw forces sealant into various spaces around (1) threads, (2) head and (3) clearance hole to give hermetic sealing.



When screw is tightened the compound seals clearance hole and top thread; between washer and surface; between head and washer.

The washer has ability to conform to curved surfaces and still seal securely against hydrostatic pressures and wind driven water. Its spring tension and flat rim give the added advantage of dynamic metal to metal seal.

ONLY THE SCREW TURNS

Washer does not turn with the screw. This prevents twisting or tearing the sealing "gasket", marring of polished surfaces, or gouging of painted finishes.

The flow-in gasketing compound is plastic rather than elastic. Stable and non aging, it won't split or ozone-check under pressure. It gives controlled flow into clearance spaces. Compounds are available to seal out water or oil.

Send for Bulletin SS-1 which gives details on RB&W "SPIN-SEAL" fasteners. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y. *T.M.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco

For more information fill in page number on Inquiry Card, on page 195

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

THREAD-ROLLING HEADS — National Acme Co., Cleveland, Ohio. 20-page illustrated Acme-Fette catalogue NAF-57A, depicting advantages of rolling threads from the end of the work-piece with self-opening thread-rolling heads. It also lists specifications, dimensions, capacities, and replacement parts, and gives general instructions on blank preparation, rolling, installation, and operating methods. Requests for Acme-Fette catalogue may be made on company letterheads.

MAGNESIUM ALLOYS—White Metal Rolling & Stamping Corporation, Brooklyn, N. Y. 54-page booklet, describing the properties, uses, applications and advantages of magnesium. Whitelight magnesium alloys are available in bars, rods, tubes, sheets, plates, strips, wire and structural, semi-hollow and hollow shapes. They are non-toxic, non-sparking, non-magnetic, and non-smudging. Free sliding and non-galling, with high thermal and sound conductivity, good light and heat reflectivity, and a low coefficient of friction, they are applicable in both the industrial and commercial fields. 1

GENERAL PURPOSE CONTROL CATALOGUE—General Electric Co., Schenectady, N. Y. 88-page publication GEC-1260C, covering complete line of control devices manufactured by General Electric's General Purpose Control Department. Selection charts covering starters through 200 hp provide quick selection of the proper starter, heater, and push-button station for any type of enclosure, as well as guide form specifications for easy and accurate designation of controls by distributors, contractors, or architectural specifiers. It is indexed and contains prices, features, wiring diagrams, etc. 2

STABILIZED CERAMICS—Norton Co., Worcester, Mass. Bulletin 686 NP 1, describing the physical properties of three new engineering materials. These are CRYSTOLON "N" (nitride bonded), CRYSTOLON "R" (recrystalized or self-bonded) and CRYSTOLON "C" (a coating). These three ceramics have been developed to meet the need for materials able to withstand temperatures too severe for metals. They offer resistance to thermal shock and extreme temperatures as high as 4000 degrees F. All three are being used in the rocket motor field. . .3

COLD ROLL-FORMING — Yoder Co., Cleveland, Ohio. 88-page reference manual, telling how to produce a wide variety of metal shapes, including a clear discussion of the economics, mechanics and possible applications of the cold roll-forming process to various sized manufacturing operations. It offers assistance in selecting the correct size and capacity of equipment. Production costs, operating speeds, tooling, surface finish, uniformity, forming of precoated stock, and personnel training and operating techniques are described in relation to the end uses and the raw stocks involved in a variety of examples. Complete "how-to" instructions on curving, coiling, ring-forming, notching, perforating, welding, and embossing are included. 4

FLAME-CUTTING MACHINES — Linde Company, Division of Union Carbide Corporation, New York City. 28-page catalogue, Form 4487, describing a complete line of oxweld flame-cutting machines. They range in size from small portable machines that can be carried around a shop by one man to large multi-blowpipe shape-cutting machines capable of reproducing thousands of intricate patterns in steel. Also included are complete specifications for each machine, illustrations of typical installations, and a description of machine accessories such as automatic and magnetic tracing units. 5

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"QAF" FASTENER—Waldes Kohinoor, Inc., Long Island City, N. Y. Two bulletins containing complete engineering specifications and qualification test data for the Waldes QAF quick-action stressed panel fastener. They also give descriptions of the fastener, which is designed for use on structural load-carrying panels in aircraft, guided missiles, and other applications where quick access to service areas is required. 6

VAPOR DEGREASING — Chlorinated Products Division, Diamond Alkali Co., Cleveland, Ohio. 12-page bulletin, presenting brief data covering 13 major advantages provided by vapor degreasing in production cleaning and metal surface preparation for electroplating, painting, and other finishing operations. Related subjects discussed include the essentials of vapor degreasing equipment, methods of scheduling vapor degreaser cleanouts and solvent distillation, and suggested operating procedures. A tabulation of the physical properties of perchlorethylene completes this presentation. 7

DRILL PRESS AND MACHINE VISE—Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. Catalogue 691, describing Drill Press Vise and the latest design improvements in Wilton's MilOmatic air-hydraulic vise. MilOmatics provide instant, automatic clamping action, can be moved easily from machine to machine, and can be adapted to an unlimited variety of jobs with low-cost jaw inserts. Wilton Drill Press Vises are designed to provide huge jaw capacity within compact overall dimensions. Six models are available. . . 8

TUBULAR PRODUCTS—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. 16-page booklet TB-417, presenting information on the application of tubing, pipe, and welding fittings. Included are application data, points to consider in selection of materials, analysis as well as physical, mechanical and creep strength properties of various steels 9

ASSEMBLY COMPONENTS—PIC Design Corporation, a subsidiary of Benrus Watch Co., Inc., East Rockaway, N. Y. 24-page catalogue No. 15, listing 500 newly designed packaged components such as: worm and wheel and speed reducer assemblies, helical gear assemblies, and magnetic clutches. 10

CHEMICAL TREATMENTS OF METALS —American Chemical Paint Co., Ambler, Pa. 8-page brochure, describing various chemical conversion coatings for steel, aluminum, galvanized iron, zinc, and cadmium-plated surfaces; for corrosion resistance, paint bonding, drawing and forming, and protection for friction surfaces. Also listed are current specification chemicals for the government and its contractors. 11

RUST PREVENTIVE—Daubert Chemical Co., Chicago, Ill. Rust Preventive Chart No. 158, listing the various military specifications and conforming NOX-RUST products. A detailed description of properties and applications of some of the company's products is included. This chart is designed to aid contractors, packaging engineers, and government inspectors who need a ready reference to preservatives for both military and commercial use. 12

GRINDING MACHINE — Cincinnati Grinders, Inc., Cincinnati, Ohio. 19-page Bulletin G-703, describing Cincinnati® Filmatic® No. 1 centerless grinding machine, a small general-purpose machine suitable for grinding a wide range of metallic or non-metallic parts up to 1 1/2 inches in diameter. This machine is recommended for the rapid, accurate production of small drills. 13

SELF-LOCKING SET SCREW—Set Screw & Mfg. Co., Bartlett, Ill. "Selector" chart, showing over 1001 availabilities in self-locking set screws. Purpose of the chart is to assist engineers and specifiers in evaluating the many opportunities for the use of this product. Suggested uses of this locking device cover applications ranging from hardened steel to plastics. 14

SELECTOR CHART—DoALL Co., Des Plaines, Ill. 22- by 28-inch wall chart, simplifying the selection of ground flat stock. More than 1500 standard sizes of individually packed oil hardening and air hardening tool steel are listed, together with analyses, tolerances, and decimal equivalents. 15

GEAR GENERATORS — Farrel-Birmingham Co., Inc., Ansonia, Conn. 32-page Bulletin 460, containing specifications, information on sizes and capacities, and illustrations of machines in both the T and C series. Also included are descriptions of design features of these machines, which give them the capability of generating gears of all types which operate on parallel axes. Present designs represent the culmination of over thirty years of research and development. . . 16

TOOL-HOLDERS AND "THROW-AWAY" INSERTS—Metal Carbides Corporation, Youngstown, Ohio. 8-page Catalogue KL-58, covering the company's "Klamp-Lok" tool-holders with Talide "Throw-Away" inserts. There are three pages of diagrams describing these products. Their tool order numbers, holder dimensions, prices and parts groups are given in easy-to-read tables. 17

PROTECTIVE COATINGS—Rust-Oleum Corporation, Evanston, Ill. 36-page manual, Form 257, featuring actual color chips of 102 different coating items. It contains complete sections devoted to methods of surface preparation, use of primers, and finish coatings, and the availability of special custom coatings where required. Sections of the manual include oil field finishes, restful color groups, and heat- and chemical-resistant coatings. 18

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GAGES—Mueller Laboratory, Pasadena, Calif. 1 page, 2-color folder, describing adjustable depth and groove location gages for locating and measuring grooves of any type in one setting. The width of the groove can be read directly off the indicator. The Mueller dial depth gage is fully adjustable, lightweight, easy to operate, and perfectly balanced. The measuring rods are made of hardened drill rod. One end is flat and lapped. The opposite end has a radius. **19**

INDICATING-CONTROLLING PYROMETER—Illinois Testing Laboratories, Inc., Chicago, Ill. Bulletin describing the Alnor Pyrotroller® which gives complete indicator and controller specifications in addition to typical wiring diagrams showing application of the Pyrotroller on electrically heated, gas- or oil-fired equipment. **20**

ALUMINUM MILL PRODUCTS—Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill. 24-page booklet, offering data on aluminum characteristics, fabricating and finishing techniques, mechanical and physical properties of alloys, and company services to customers. Kaiser Aluminum mill products include sheet, plate, foil, circles, casting alloys, pig, alloy ingot, rod, forgings and extrusions. **21**

FASTENERS—Simmons Fastener Corporation, Albany, N. Y. 40-page catalogue, providing detailed specifications, engineering drawings, applications, and installation information. Data on the new Hinge-Lock and Spring-Loaded Link-Lock is given as well as complete details on other Simmons special fasteners. **22**

TOOL ROOM GRINDING—Robertson Mfg. Co., Trenton, N. J. Bulletin, illustrating with views of tool-room operations, containing tables of wheel types, sizes and markings applicable for high-speed steel cutter and drill sharpening; vertical spindle, rotary table and reciprocating table surface grinding; cylindrical grinding, hob sharpening, carbide tool grinding, and high-speed steel cutting. **23**

PENINSULAR SNAGGING HANDBOOK—Peninsular Grinding Wheel Sales Corporation, Detroit, Mich. Illustrated handbook, for foundries, metal fabricators and steel mills, describing developments in resinoid wheels, and giving detailed charts discussing proper handling, labor costs, etc. **24**

MS2 PRESSES—Minster Machine Co., Minster, Ohio. Illustrated 8-page bulletin, describing the MS2, two-point, straight-side, double-geared presses, ranging in capacity from 150 to 500 tons. The patented Intermediate Shaft Combination Air Friction Clutch and Brake drive arrangement which allows this press to deliver single-stroke efficiency is described and illustrated in detail. **25**

OPTICAL PROJECTORS—Eastman Kodak Co., Rochester, N. Y. 16-page booklet, describing features of the various Kodak Contour Projectors, and detailing the various applications for optical gaging in the tool-room, on the production line, in receiving and in final inspection. Projector accessories such as the lens turret, vertical beam unit, and V-blocks are also described in easy-to-read chart form. **26**

OVERHEAD DOORS — Barber-Coleman Co., Rockford, Ill. 16-page catalogue, presenting the Barcol OVERdoors line of residential, commercial, and industrial overhead doors, with information on Weather-King flush overhead door sections, combining high-insulation-value sandwich construction with weatherproof facing. Weather-King door panels, Electric Operators, Cam-Action closing hardware, Radio Controls, and Special Controls are also described. **27**

LATHES—Cincinnati Lathe & Tool Co., Cincinnati, Ohio. 8-page booklet presenting a check list of minimum requirements in design and construction features to obtain low-cost operation and maintenance, applying particularly to light-duty engine and toolroom lathes. **28**

PRESS REBUILDING—E. W. Bliss Co., Canton, Ohio. 8-page Bulletin #47, entitled "Revitalizing Older Presses Through Press Rebuilding," explaining how older presses can be restored to their original operating efficiency. It also describes Bliss' complete replacement parts inventories. **29**

SUPERFINISHING—Gisholt Machine Co., Madison, Wis. 44-page catalogue, describing Superfinisher machine. Also included are sections on automatic size control, engineering service available, and floor plans. In addition, 34 different job applications are illustrated and explained. **30**

TRANSFORMERS — Allis-Chalmers Mfg. Co., Milwaukee, Wis. 19-page bulletin, 61B6186C, describing a line of transformers along with their design and construction features. Also covered are Allis-Chalmer's power, unit substation,

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secondary network, industrial application, furnace, distribution, and instrument transformers. 31

ECCENTRIC GEAR PRESSES—Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. 8-page bulletin, No. 13301, including illustrations, sketches, application data, specification tables, as well as design and construction details, to aid production engineers and designers. 32

JIG BORERS AND GRINDERS—Fosdick Machine Tool Co., Cincinnati, Ohio. Bulletin describing a system which can be controlled by either punched tape or cards. It describes other functions which can be programmed, such as table and saddle locations, spindle feeds and speeds, and spindle-head height. 33

PORTABLE WELDER—Lincoln Electric Co., Cleveland, Ohio. Folder illustrating uses of Weldanpower, a portable welder with various functions, such as running irrigation pumps, making field repairs, and erecting steel and pipe in construction. 34

CAMS AND CAM-MAKING MACHINES—Rowbottom Machine Co., Waterbury, Conn. 4-page catalogue, C-58, illustrating variety of box, barrel, side, and index cams and describing universal cam milling and grinding machines. 35

CASE HISTORY BULLETINS — Lewis-Shepard Products, Inc., Watertown, Mass. Two bulletins describing how companies solved their materials-handling problems. Bulletin No. 397-1 presents the story of a plastics manufacturing company and its method of ending a die handling problem. Bulletin No. 276-1 relates the results achieved by a printing firm in modernizing its techniques of handling paper. 36

STEEL TUBING DATA—Brainard Steel Tubing Division, Sharon Steel Corporation, Warren, Ohio. 12-page, two-color catalogue containing complete technical working data on the company's mechanical steel tubing. Majority of the book is devoted to tables showing size ranges and cutting and size tolerances of round square, and rectangular tubing. 37

PUNCHES AND DIES—T. H. Lewthwaite Machine Co., New York City. Catalogue sheets, listing a line of metalworking punches, dies, machines, and accessories. They introduce a die-marking system. There are charts and instructions for figuring clearances to allow for both type and thickness of material being punched. 38

FIRE PROTECTION SERVICE PLAN—Ansul Chemical Co., Marinette, Wis. Brochure pointing out how a company can do a complete job of protecting itself against damaging fire loss. "Fire Service Plan" emphasizes the need for fire fighting training and fire prevention. 39

HYDRAULIC CYLINDERS—Oilgear Co., Milwaukee, Wis. 8-page bulletin 71000, describing the company's line of 2000-psi, double-acting hydraulic cylinders. It gives its line of foot lug, center lug, front flange, rear flange, and clevis mounted cylinders for all users of straight-line power. 40

VERTICAL 4-SLIDE MACHINE—A. H. Nilson Machine Co., Shelton, Conn. Catalogue No. V-187, containing a complete specifications table on the machine, as well as pointing out advantages of vertical 4-slide equipment. It also covers specific machine design features. ...41

TRACING TEMPLATE — Northwestern Tools, Inc., Dayton, Ohio. 4-page brochure giving over 200 components for jigs and fixtures in full scale. 42

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1 2 3 4 5 6 7 8 9 10 11 12 13 14
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29 30 31 32 33 34 35 36 37 38 39 40 41 42

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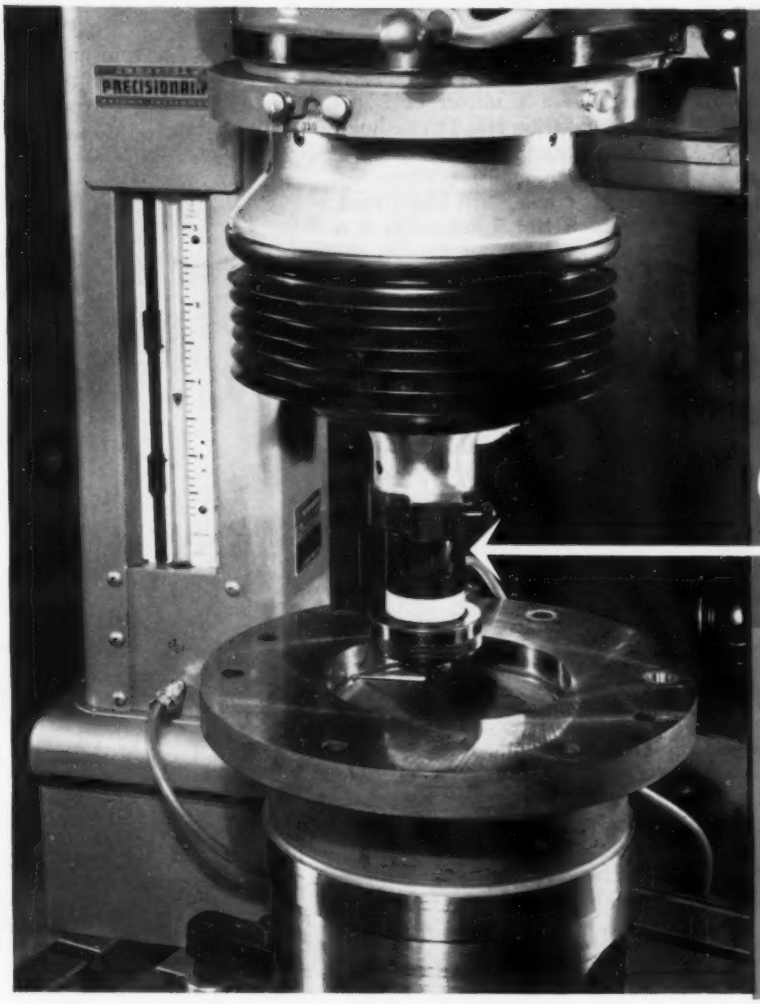

New SHEFFIELD "Centerfind"

Assures PRECISE ALIGNMENT for Jig Grinding or Boring

"Centerfind" enables an operator to align a work part hole precisely with the jig bore or jig grinder spindle axis.

A pressure-sensitive pick-up stylus is rotated by the spindle to tram the inner surface of the work part hole. As the stylus moves through its orbit, any change in pressure on it indicates misalignment and this is registered on the column Precisionaire. When the hole center is brought into precise alignment, the Precisionaire float remains stationary.

Checking is done while the spindle rotates, thus eliminating torque error which is a serious obstacle when alignment is attempted from a stationary spindle.

Because spindle-to-stylus distance approximates boring tool length, variations caused by vertical quill movement are minimized.

In addition to the reasons above, the high degree of accuracy obtainable with "Centerfind" is due to having only one moving part and the high amplification of the Precisionaire gage.

Other uses for this instrument are the checking of spindle runout and the squareness of a hole with its adjacent face.

"Centerfind" for checking holes up to 5" dia. is recommended to be used with Precisionaire Gages of 2000 or 5000 to 1 amplification. Higher amplifications and larger hole diameter capacity, when required.

For further information, write to The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 9.

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been processed on the first machine, the parts are sawed in another operation to produce rods and caps. In the second center-column machine, the two holes for attaching the caps to the rods are drilled, chamfered, and reamed for a later threading of the screw-holes. In this second machine, the parts are loaded vertically in the fixture and located on the reamed piston-pin holes in position No. 1. In position No. 2 the two holes are drilled halfway through to a diameter of 23/64 inch. In position No. 3 these holes are drilled through to a diameter of 0.316 inch, and in position No. 4 the two holes are chamfered. In position No. 5 a combination two-diameter reamer finishes the holes to size, after which the parts are unloaded.

Circle Item 130 on postcard, page 195

Atlas 12-Inch General-Purpose Lathe

A general-purpose, low-cost lathe of rugged construction designed for accurate handling of a wide range of turning work has been announced by the Atlas Press Co., Kalamazoo, Mich. This new lathe has a 12 1/2-inch swing over the bed, 12-inch swing over the saddle wings, 8-inch swing over the cross-slide, and will take work up to 36 inches long between centers.

The lathe is accurately built for close tolerance work. Massive headstock and tailstock, heavy-duty bed, and rugged carriage insure rigidity. Timken tapered roller bearings insure long accuracy life for the spindle and permit handling high-speed work as well as heavy-duty turning at normal speeds. Tops, sides, and bottoms of bedways are precision ground to close tolerances, and the headstock, carriage, and tailstock are hand-fitted to the bed. Standard equipment includes complete V-belt drive that provides sixteen spindle speeds; power cross- and longitudinal-feeds, and wide feed and thread-cutting range.

The new 12-inch lathe is available in pedestal base models with underneath drive using two V-belts to turn the spindle, and in bench models with horizontal bench-mounted countershaft. Quick-change gear models provide fifty-four speeds ranging from 4 to 240 rpm and standard change-gear lathes, ninety-eight speeds from 4 to 96 rpm.

Circle Item 131 on postcard, page 195

General-purpose lathe brought out by the Atlas Press Co.

Flush-head aircraft screws with "Torq-Set" recess announced by the Standard Pressed Steel Co.

Flush-Head Aircraft Screws

The "Torq-Set" recess, designed to allow maximum tightening of screws without slipping of the driver or causing burred slots or broken heads, has been introduced on all flush-head aircraft screws made by the Standard Pressed Steel Co., Jenkintown, Pa., and its Los Angeles affiliate, Cooper Precision Products. The higher clamping force obtained with the Torq-Set screws serves to insure a better seal on wet-wing aircraft applications. Since their recommended minimum pre-load, when properly tightened, is greater than the maximum service load, these screws will not fail in service. Resistance to vibration can be increased by the addition, to the threaded portion, of Nylok inserts—an optional self-locking feature.

Torq-Set aircraft screws with 100 per cent flush-heads are available in sizes ranging from 10-32 to 5/8-18. Simple one-piece drivers, needed to install Torq-Set screws, also will be marketed.

Circle Item 132 on postcard, page 195

(This section continued on page 202)

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.

Write for your free copy of this important booklet today!

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

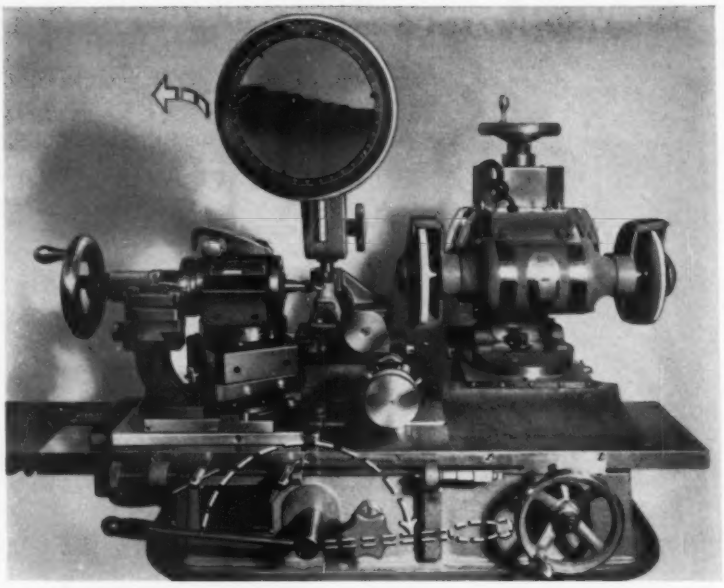
For more information fill in page number on Inquiry Card, on page 195

Grinder Equipped with Optical Comparator for Checking Work

The Royal Oak Tool & Machine Co., Royal Oak, Mich., is introducing a model R-O universal form-relieving fixture and grinder equipped with an optical comparator. This newly developed attachment is mounted on a bracket attached to the grinder. It swings from an out-of-the-way position, bringing the lens over the work and projecting the profile, with a 20-to-1 magnification on the 8-inch diameter ground glass when the actuating lever is moved to the position shown.

This equipment permits checking progress of the grinding work by accurate comparison with the enlarged template drawn on the glass. The attachment in no way interferes with setup or operation of the equipment. Optical checking and return of the work to the grinding position can be done in a matter of seconds since the tool remains in the chuck and the fixture setup is undisturbed. The optical comparator is available on new equipment and can be installed on existing grinders by returning the grinder table to the factory.

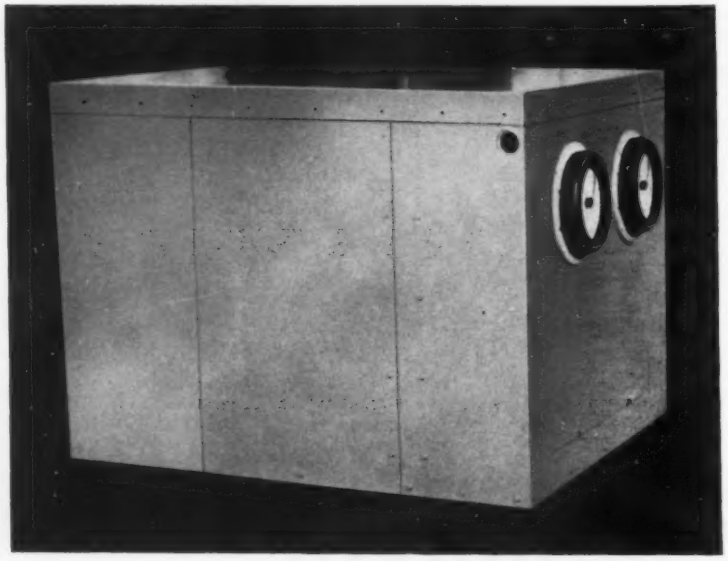
Circle Item 133 on postcard, page 195



Moving the lever to position shown by dotted lines swings optical comparator back out of the way and brings work into position to continue grinding

Versatile Multi-Arc Welding System and Equipment

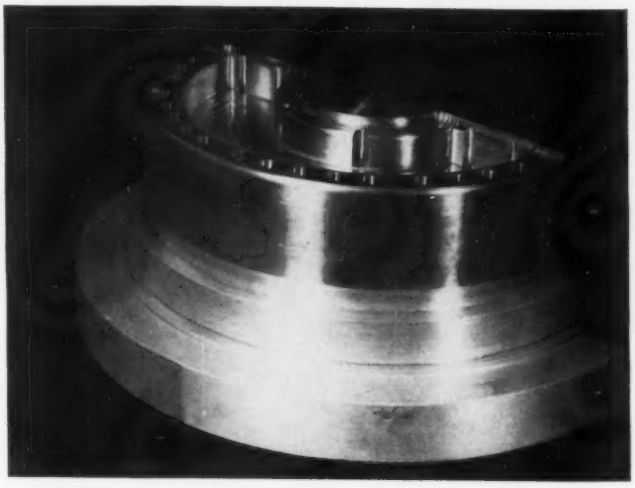
A new concept in multi-arc welding from a single power source system has been developed by the Welding Products Division, A. O. Smith Corporation, Milwaukee, Wis. This new system and equipment enable from fifteen to forty men to engage in welding operations simultaneously, the exact number employed depending of course on the specific welding work to be done and the size or capacity of the new welding equipment employed. The new A. O. Smith 750- or 1500-ampere, direct-current, constant-potential power sources of the new system are used in conjunction with series resistance grids designed for arc welding, tack welding, stud welding, arc air gouging, and inert arc welding operations. This unique system is suitable for use in such field construction work as shipbuilding and the erection of buildings and bridges, as well as in manufacturing plants where general steel fabricating is performed under normal duty cycles.



Direct-current constant-potential power source unit used in conjunction with series grids in multi-arc welding system developed by A. O. Smith Corporation

The new units are said to occupy considerably less space than a group of single-operator welding sets and to enable the welding operator to adjust his heat from his work position, no matter how far he is from the power source, by locating the series grid near his work. The system reduces by at least 80 per cent the primary power connection and welding lead problem and provides excellent welding charac-

All these operations on complex pattern . . .



1. Face top of bronze casting to height.
2. Face end of casting at centerline.
3. Cut 2.260 radius and 4.225 radius .778 deep, leaving a .220 wall at centerline.
4. Cut 1.755 radius .200 deep with .200 radius at bottom.
5. By Vernier scale on mill, drill and bore 6 holes 15/64 diameter, 15/16 deep and 17 holes .450 diameter, 4½ deep with power fed head.

Completed in one setup with BOKOE #3 MILLER

1. Used as conventional mill
2. Conventional mill with rotary table
3. Boring mill for close tolerance—deep holes

How would you do it in your shop?

Could you handle so many different operations on *one* machine—in *one* setup?

They're doing it on the BOKOE Boring and Milling Machine at Morris Bean & Company, Yellow Springs, Ohio—producing intricate patterns like this for their Antioch Process castings for aircraft and missiles. And they tell us the BOKOE is so much faster, so economical and so accurate through the whole range of multiple operations that "the company's engineering people are most happy with their new do-anything tool."

More and more plants feel the same way about their BOKOE Millers—for the same good-production reasons. Companies like Convair, Ford, General Electric, Lockheed, General Motors, for example.

You will, too, when you see how the BOKOE #3 Universal Miller does the work of several machines—at the cost of only *one*. Worth writing for more details, isn't it? Or, talk it over with us.

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KURT ORBAN COMPANY, INC.

42 Exchange Place, Jersey City 2, New Jersey

For more information fill in page number on Inquiry Card, on page 195

teristics. The new equipment can also power a number of stud welders or drive extremely large studs, in addition to operating many arcs from the single power unit.

The electrical specifications of the Model 15000 CP power source are: primary voltage 460 or 600 volts, 3 phase, 60 cycle; primary rating requirement 134 KVA; efficiency 94 per cent; power factor 96 per cent lag; open circuit rating 80 volts direct current; full load rating 75.5 direct current; rated output current 1500 amperes; and short time overload 2250 amperes for 2 minutes before automatic shut-down.

Many styles of grids are available, but the three most common are: an individual operator's grid in a readily portable package having handle-operated toggle switches for output range selection; a rack containing six individual operator's grids in a single assembly; and relatively fixed output type drawers, which are used mostly for tack-welding service. The adjustable output units can be made to a customer's specifications, but normally come with 5- and 10-ampere increments, depending upon requirements.

Circle Item 134 on postcard, page 195

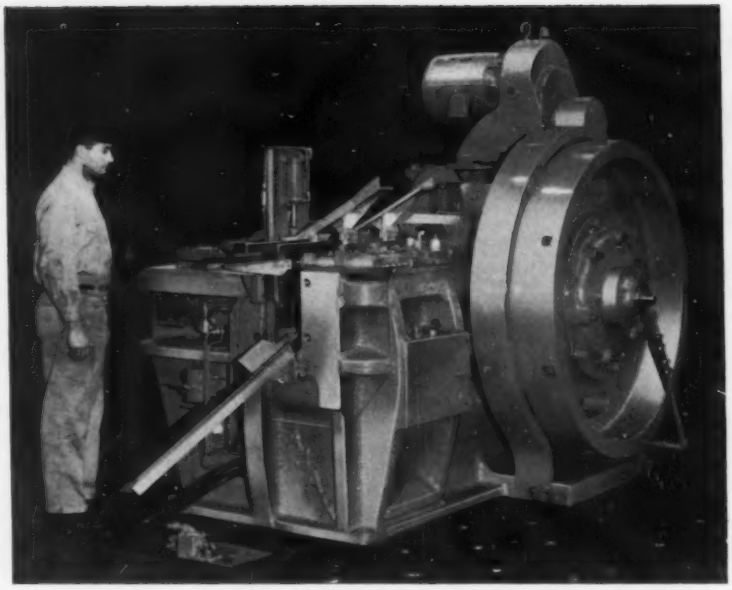

Fig. 1. Ajax forging machine with automatic work transfer mechanism

Automatic Transfer Mechanisms for Ajax Forging Machines

Forging machines made by the Ajax Mfg. Co., Cleveland, Ohio, are now being equipped with automatic feeding mechanisms. The 1 1/2-inch Ajax forging machine shown in Fig. 1 is equipped with a feed mechanism which transfers the blanks automatically from the loading chute and down through the forging operations. Blanks of various lengths ranging from 8 to 30 inches or longer can be fed into the machine by the mechanism shown in Fig. 2. The diameter of the stock handled by this mechanism varies from 1/2 to 7/8 inch, depending on size of upset.

The blank is heated only on the end to be upset, and is lowered

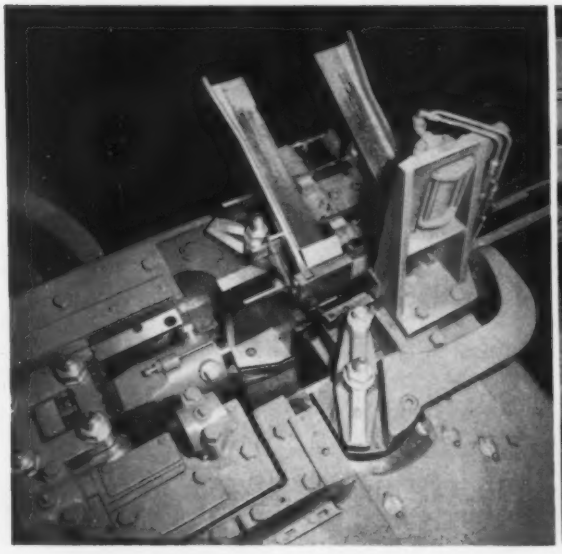

Fig. 2. Automatic transfer mechanism of forging machine shown in Fig. 1

Fig. 3. Automatic transfer mechanism applied to 3-inch Ajax forging machine

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for the die operations in the throat of the machine by means of air-actuated grips. The blank is rotated between operations to assure uniform heading. Production is continuous, heading a bolt in two operations and completing a forging at each stroke.

Another type of automatic forging system is incorporated in a 3-inch Ajax forging machine in which round stock is transferred from the loading chute and lowered for each operation in the throat of the machine. This machine has a somewhat different mechanism, as shown in Fig. 3. The system is based on a series of cams which actuate mechanical grips and lower the stock through each forging operation. In this case the forging machine was automated to forge stem pinions from stock 1 9/16 inches in diameter by 15 1/2 inches long, and weighing 8 1/4 pounds. Since there is a blank in each operating position at all times, a forging is produced and automatically ejected into a lower chute with every revolution of the machine.

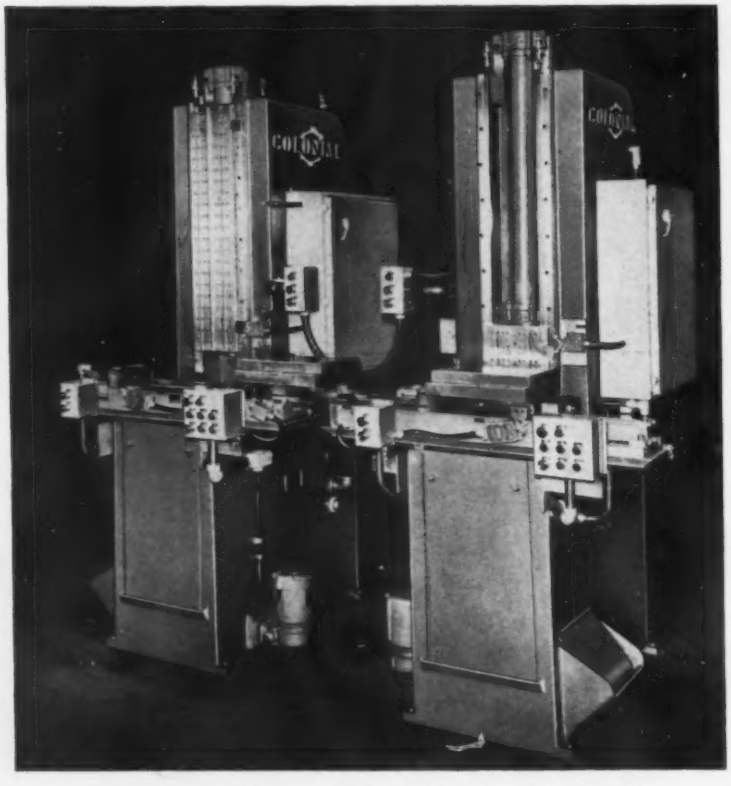
Circle Item 135 on postcard, page 195

Paired Broaching Machines with Mutual Fixtures and Controls Operate as Unit

Faster and more economical production of small parts is said to be possible with a pair of broaching machines arranged to operate as a single unit by the Colonial Broach & Machine Co., Detroit, Mich. Two Colonial standard "Ram-Press" broaching machines in the 4-ton, 42-inch stroke model are mounted side by side to form a unit that permits one operator to run both machines easily. The Ram-Press is a four-way machine that does surface broaching, internal push or pull broaching, and press work.

The two machines are held to-

(*Continued on page 208*)



Production broaching unit consisting of two Colonial broaching machines electrically interlocked for single operator control

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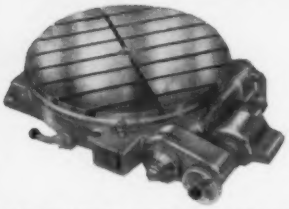

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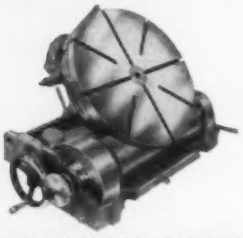
- 12-Inch Hand Operated
- 20-Inch Hand Operated
- 24-Inch Motor-Driven
- 30-Inch Motor-Driven
- 42-Inch Motor-Driven
- 50-Inch Motor-Driven

OPTICAL ROTARY TABLE
- 24-Inch Horizontal

AUTOMATIC INDEXING
- 42-Inch Horizontal

NUMERICALLY CONTROLLED
- 42-Inch Horizontal



TILTING ROTARY TABLES
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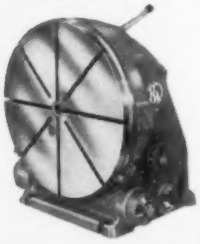
- 16-Inch Hand Operated
- 24-Inch Power Rotated
- 36-Inch Power Rotated



VERTICAL ROTARY TABLES
- 30-Inch Motor-Driven
- 48-Inch Motor-Driven

NUMERICALLY CONTROLLED
- 30-Inch Vertical

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Equipped with Numerical Control, this Pratt & Whitney 42" Rotary Table is bringing new standards of speed and efficiency to high-precision work volving circular spacing or angular positioning.
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Whatever your requirements on jobs involving accurate circular spacing or angular positioning, you'll find the *right* rotary table in our complete line. All of the 16 available sizes and models are accurate to a few seconds of arc . . . and if you require the ultimate in precision, the P&W Optical Rotary Table has a guaranteed overall accuracy of *3 seconds of arc*. This is *real accuracy* when you realize there are 1,296,000 seconds in a complete circle!

P&W Rotary Tables are built for ruggedness and stamina as well as precision. Whether you use them in conjunction with jig borers and other tools to save time and set-up in machining operations . . . or by themselves for faster, more accurate inspection, circular graduating or layout . . . P&W Rotary Tables will take continuous, heavy-duty work in stride.

Get all the facts on the 16 sizes and models of Pratt & Whitney *Precision* Rotary Tables now. See how one of these tables can bring new speed, accuracy and economy to your operations. Use the coupon above to send for your copy of our new circular, which tells you all about these precision rotary tables.

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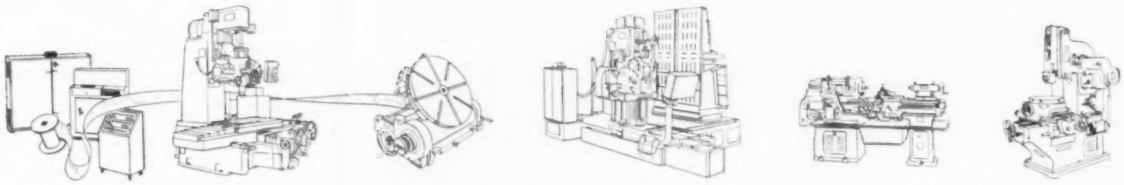

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gether by the mounting installation and are electrically interlocked. Mutually employed fixtures and controls allow each unit to achieve maximum efficiency with a semi-automatic machining cycle, the operator loading one machine while the other is broaching the work.

This dual setup is available with all models of the Ram-Press line up to the 10-ton model. Both machines operate at a broaching speed of 60 surface feet per minute and a broach-return speed of 120 feet per minute. The operator's position between the machines facilitates loading both tables. The tables are of the side-shuttle type, interlocked for directional movement control. The sequence for each machine is shuttle out, load, shuttle in, and broach. An interlocked electrical circuit keeps the two machine cycles "out-of-phase" with each other. The machines are controlled from a central pendant through a "quick-disconnect" cable. Each machine has a control panel and is equipped with its own hydraulic system. It can be used as a separate unit when desired.

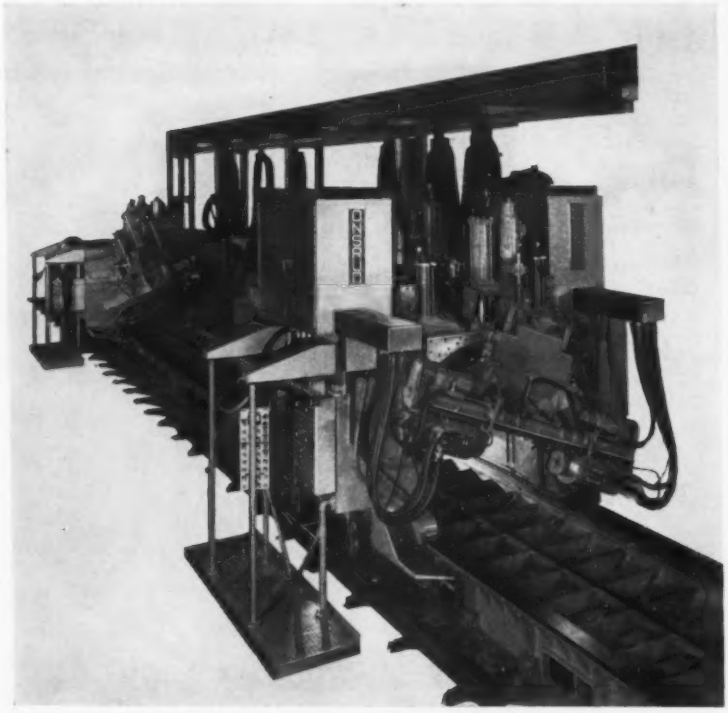
Circle Item 136 on postcard, page 195

Onsrud Automatic Contour-Milling Machine Equipped with Electro-Hydraulic Feeds

An Onsrud A90-36A automatic contour-milling machine built recently for Convair provides electro-hydraulic drive for the critical feed components of multiple-feed milling heads so that production speed and accuracy can be maintained throughout a milling operation. These electro-hydraulic drives are said to give an exceptional over-all increase in speed or greater accuracy. The systems were developed by the Onsrud Machine Works, Inc., Niles, Ill., in cooperation with the General Electric Co.

The No. 6 horizontal milling head of the machine provides an example of the application of the

(*Continued on page 210*)



Automatic contour-milling machine with electro-hydraulic feeds announced by Onsrud Machine Works, Inc.

Let me show you*

**Bob Marr,*
P&J Representative
Houston, Texas.
Telephone: ME 1rose 7-3964

how changing to a P&J Automatic helped Reed Roller Bit Compan

JOB FACTS:

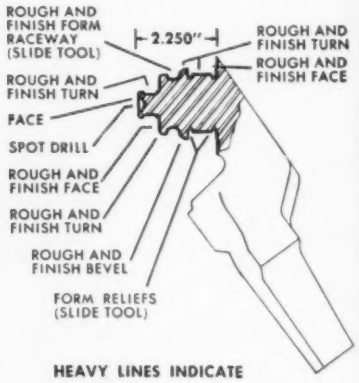
PART: *Lug for Oil Well Bit*

MATERIAL: *AISI 8720 Steel Forging*

REQUIRED: *Several complex, precision cuts, with certain diameters held to .004" of nominal size.*

THE MACHINE: *A 6DRE-40 Automatic Turret Lathe*

THE RESULTS: *Part completed in single, fully automatic cycle. Machine cycle time just 4.5 minutes!*

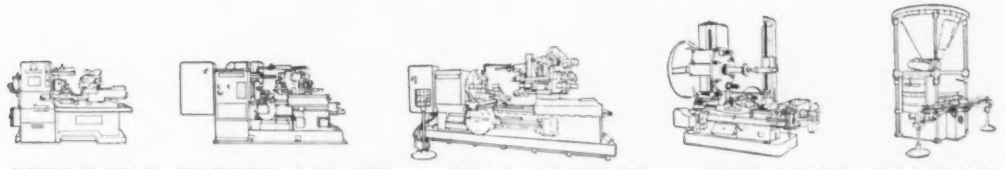


HEAVY LINES INDICATE MACHINED SURFACES

. . ELIMINATE 4 MACHINES and REDUCE OPERATING COSTS!

One of our Potter & Johnston 6DRE-40 Automatic Turret Lathes was recently installed in Houston, Texas at the plant of the Reed Roller Bit Company . . . a leading producer of oil well drilling tools. Handling a series of complex cuts on a tough steel forging, this new P&J machine and one operator have replaced 5 semi-automatic machines and released four skilled operators for other important work. Machine cycle time has been cut to 4.5 minutes. These reductions have produced important money savings *plus* a big and badly needed increase in output. And in addition to meeting all these basic requirements, the 6DRE-40 has also proved its toughness. Despite heavy metal removal on an exceptionally tough alloy, this P&J Automatic is operated successfully on a 3-shift basis with time out only for routine cleaning and maintenance.

If – like the Reed Roller Bit Company – you have tough-to-machine jobs you'd like to turn out more economically, a switch from hand or semi-automatic machines to P&J Automatics can do the trick for you too! Act today. Ask the P&J Representative in your area to analyze your requirements and recommend a production plan to meet your specific needs. If you prefer, write direct to Potter & Johnston Company, Pawtucket, Rhode Island.



AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . PACKAGING MACHINES

POTTER & JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898

new system. This milling head has four different feed components, or four distinct motions, that are operative either singly or in any combination to give any desired resultant feed in terms of direction and magnitude. These feed components consist of longitudinal, transverse, twist (or angular), and vertical motions and are all controlled through remote Selsyn type all-electronic tracer systems.

For this particular head, the vertical feed is critical, and here electro-hydraulic drive is applied. As a result, the vertical feed component is capable of instantaneous response and high acceleration to provide an equivalence in motion for maintaining proper relationship with the other feed components under all conditions.

The machine provides a resolution accuracy to a tolerance of 0.0005 inch and a part-to-part reproducible accuracy to a tolerance of 0.0015 inch. The latter tolerance is held at a feed of 60 inches per minute on a radius of 1/2 inch. As radii increase, precision increases. The machine is equipped with six milling heads with a total of 560 hp, and has a work area 3 feet wide and 60 feet long. Over-all dimensions are 15 1/2 feet by 105 feet.

Circle Item 137 on postcard, page 195

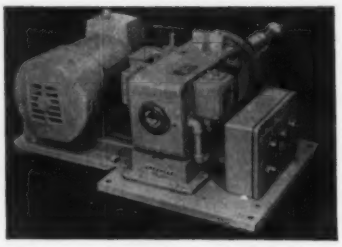
Combination Rockwell Hardness Tester

Durability and sustained accuracy are qualities claimed for the Wilson Rockwell hardness "TwinTester," recently introduced to the metalworking industry by the Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., Bridgeport, Conn. This TwinTester, a combination Rockwell and Rockwell superficial hardness testing instrument, was primarily designed for testing materials in tool departments, maintenance repair shops, laboratories, inspection departments, small-lot metal jobber shops, etc., where only limited use of hand-operated Rockwell testers is required. It is capable of performing the work of two conventional single-range units in measuring the Rockwell hardness of metals and alloys of all types, whether hard or soft, polished or unpolished, as well as round, flat, tubular, or irregular in shape. The vertical capacity of the unit is 8, 12, or 16 inches and its throat depth is 5 1/2 inches. Bench space required is approximately 12 by 20 inches.

Circle Item 138 on postcard, page 195

Greenlee Hydro-Borer

Greenlee Bros. & Co., Rockford, Ill., has developed a new, compact, packaged boring unit designated the Model S-7 Hydro-Borer which has a 1 3/4-inch diameter spindle. Although this is a low-cost unit, it is built for extremely close-tolerance boring and makes it possible to perform precision boring operations right in the production assembly line. It is especially adapted for use in precision boring on large assemblies



Hydro-Borer unit developed by Greenlee Bros. & Co.

and is designed specifically for mounting on jigs, fixtures, and multiple-station machines.

Circle Item 139 on postcard, page 195

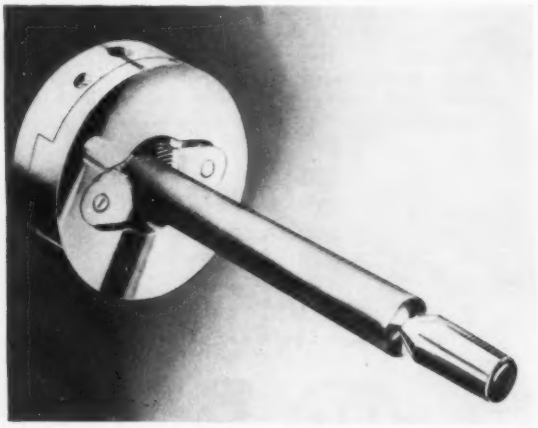
Seneca Falls Self-Centering Quick-Acting Work Driver

A new low-cost work driver with serrated jaws milled on an angle to provide a better grip on the work has been introduced by the Seneca Falls Machine Co., Seneca Falls, N. Y. This work driver may be used on any type of engine lathe, multiple tool lathe, or plain or universal grinder.

The work driver bodies are made in two types: adapter plate type which has a recessed back, the same as a conventional lathe chuck, and is mounted on a spindle by means of an adapter or chuck plate; and direct mounting type for mounting on American standard Type A-2 spindle noses. Automatic driver slides are made in four different types with several capacities. Each type assures

(*Continued on page 214*)

Wilson Rockwell hardness "TwinTester"



Seneca Falls self-centering work driver

ILLINOIS SETS THE PACE IN *BIG*

★ Here is progress-in-action to meet the fast-moving, ever-changing requirements for large gears in industry.

ILLINOIS GEAR has been meeting this challenge by constantly adding new, modern production facilities . . . the latest of which is the equipment illustrated here. It is the *newest, largest and most modern of its kind in the world.*

Spectacularly large, this precision gear cutting, hardening and testing equipment will handle spiral, Zerol and hypoid bevel gears up to 94" pitch diameter, 13" maximum face, .625 D.P. (5½" C.P.) 2.875" tooth depth and hypoid pinions to 10" offset.

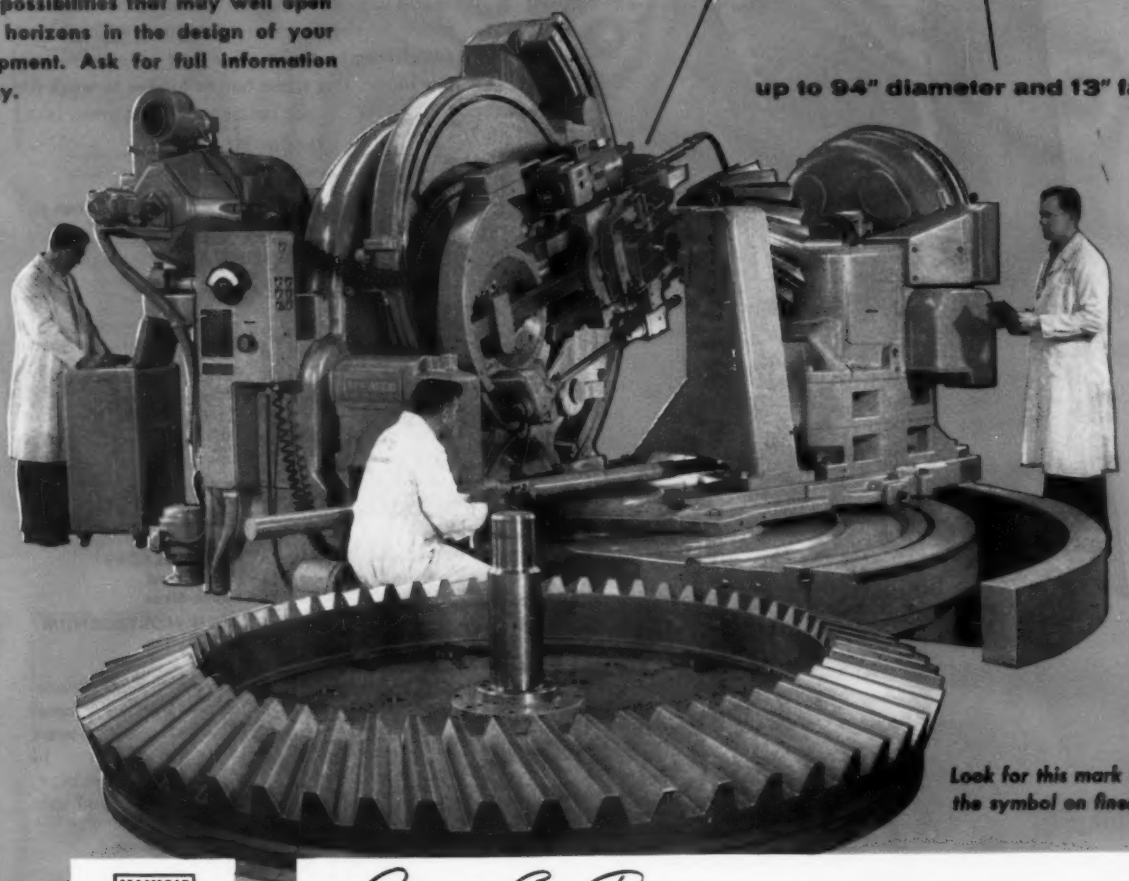
These large precision gears offer new possibilities that may well open new horizons in the design of your equipment. Ask for full information today.

SPIRAL BEVEL GEARS

ZEROL BEVEL GEARS

HYPOID BEVEL GEARS

up to 94" diameter and 13" face



Look for this mark ILLG® *the symbol on finer gears*

ILLINOIS GEARS Reg. U.S. Pat. Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

SIMONDS

gives you the right Blade . . . for every Duel with Costs

Power and hand hacksaw cutting are most efficient . . . and cost less . . . when the blade wears the Simonds "Red End". Here's why:

Accurately milled and precision-set teeth wear evenly, provide straighter cuts and longer blade life. Simonds own cross-rolled steel has more uniform grain structure with added toughness to resist wear and give more cuts per blade. Put these better blades to work for you NOW . . . get better results at lower cost!

LOOK for . . .
INSIST on . . . the blade with the "RED END"

SIMONDS

"RED END" POWER BLADES

3 Types — All Standard Lengths and Tooth Spacings

- **HIGH SPEED MOLYBDENUM**
- **HIGH SPEED TUNGSTEN**
- **HIGH SPEED "WELD EDGE"**

(Shatterproof)

For general purpose cutting, Simonds High Speed MOLYBDENUM cuts fast and straight at lowest cost. For cutting high alloys (and maximum performance) Simonds High Speed TUNGSTEN is recommended. For maximum plant safety Simonds "WELD-EDGE" is the choice — won't snap despite abuse and poor machine condition or adjustment. Pick the blade (or blades) you need, but make it *Simonds!*

SIMONDS

"RED END" HAND HACKSAW BLADES

3 Types — Hard Edge or All-Hard
Standard Lengths and Tooth Sizes

- **STANDARD STEEL**
- **HIGH SPEED MOLYBDENUM**
- **HIGH SPEED TUNGSTEN**

Again . . . pick the blade for the job. Hard Edge (blade-body tough and highly strain resistant) is best for general purpose cutting. All-Hard for quality cutting where work is securely held. "Pick your teeth" also for the job — 14 teeth for soft metals; 18 for cutting tool steels, iron pipe, etc.; 24 for drill rod, tubing, etc.; 32 for thin sheet and thin tubing.

For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

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SAW AND STEEL CO.
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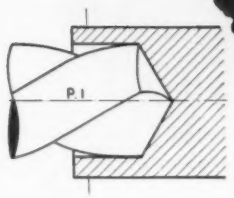
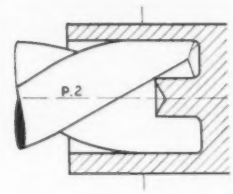
Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

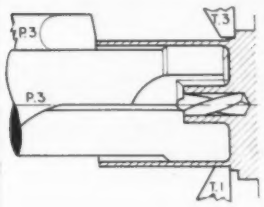
Produce Parts Like This In One Operation with BECHLER SWISS AUTOMATICS



1 Rough drill—turret pos. 1.

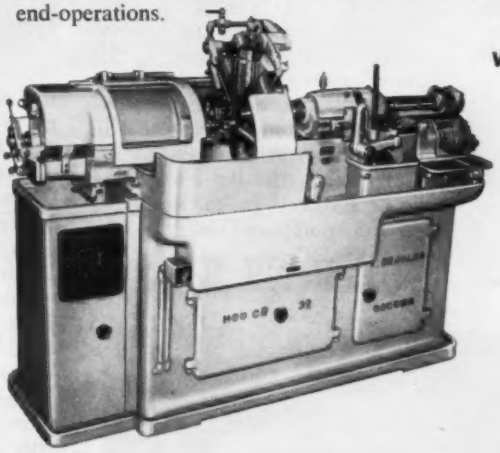


2 Rough trepan—turret pos. 2.



3 Finish trepan, drill, face-off—turret pos. 3; rough turn O.D.—tools 1 & 3.

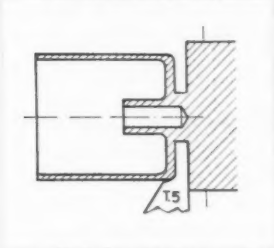
A Bechler CR-32 produced this intricate part from bar stock *in one operation*. Results were typical of Bechler performance: turning tolerances were held within .0005", concentricity to .0005", wall thickness within .0003". Improvement over a previous multi-operation method was outstanding — lower costs, fewer rejects and a better finished product. Production of such parts is relatively simple with the Bechler's unique features — 5 cross slides (T) for the famous Swiss method of single point turning with carbide tools, 6 turret stations (P) for intricate, multiple end-operations.



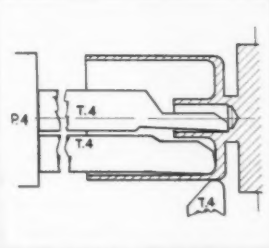
Write for Further Details

Bechler Model CR-32

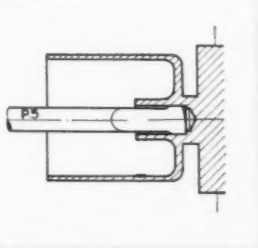
1¼" diameter capacity • 9" maximum turning length • gear driven headstock • 5 micrometer controlled cross slides • 6-spindle turret with hydraulic indexing.



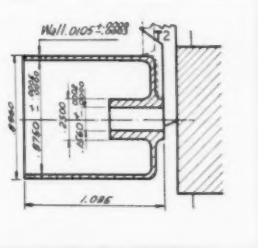
4 Rough cut outside end—tool 5.



5 Finish turn O.D. — tool 4; bore large & small I.D.'s — boring tools controlled by turret pos. 4.



6 Ream small bore—turret pos. 5.



7 Finish outside end (generation) and cut-off—tool 5.

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

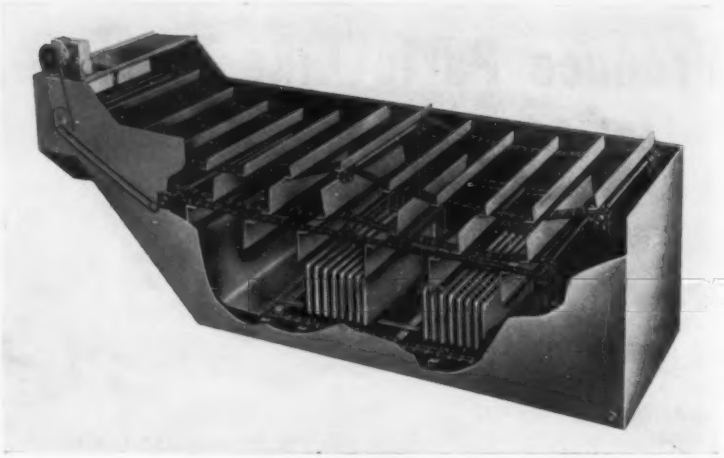
Service: — Bechler Service Corporation — 28 Harbor Street, Stamford, Connecticut

For more information fill in page number on Inquiry Card, on page 195

ample contact with the work to give sufficient gripping and driving power for its capacity range. Special slides can also be furnished for machine spindles having clockwise rotation. Driver jaws are made from alloy steel, suitably hardened.

Jaws are available with either coarse or fine serration. Coarse serrations are used in all cases where the part being driven is to be machined later. Fine serrations are used where less penetration is desirable. The driver is available in eighteen standard sizes with work diameters from 1/4 inch to 6 7/8 inches.

Circle Item 140 on postcard, page 195



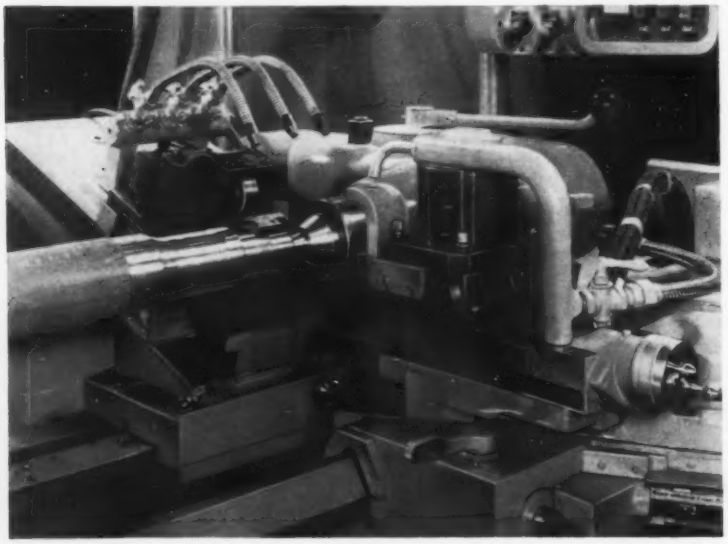
Delpark self-cleaning filter announced by Industrial Filtration Co.

Monarch Automatic Hydraulically Actuated Turret

A two-position automatic turret, featuring hydraulic actuation, is being introduced by the Monarch Machine Tool Co., Sidney, Ohio. This turret accommodates two 1-by 1 1/2-inch tools, and can be indexed 180 degrees in either direction. Operation is entirely automatic, control being supplied during machining by the multi-cycle programmer mechanism of the Monarch Model 21 Mona-Matic lathe, for which the unit is specifically designed.

The turret is positively and accurately locked by a combination of hydraulic and mechanical means. In normal operation the turret is programmed to index just prior to the last cutting cycle, so that one tool is used exclusively for finishing. Programming, however, can be varied to meet different machining requirements. An "on-off" switch permits the turret to be locked in one position, bypassing the automatic control. The automatic turret becomes an integral part of the lathe tool-slide and is actuated by the standard hydraulic pump and reservoir system of the lathe.

Circle Item 141 on postcard, page 195



Automatic hydraulically actuated turret brought out by the Monarch Machine Tool Co. for its Model 21 Mona-Matic lathe

Continuous Self-Cleaning Filter

Filter elements of leaf-type design incorporated in a new Delpark dual manifold filter recently announced by the Industrial Filtration Co., Lebanon, Ind., offer a distinct advantage in their increased area and also because of the flexibility of their filtering material. The filter media may vary through the whole range of natural, synthetic, and metallic fibers, depending on service requirements.

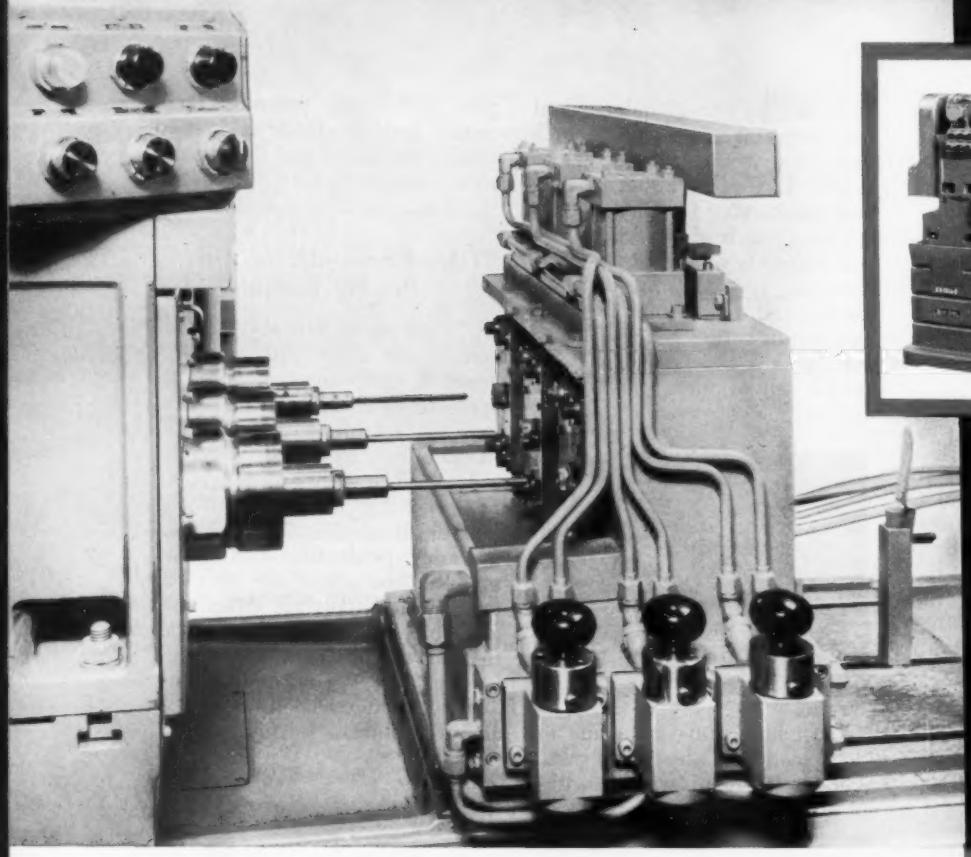
As the filter elements are cleaned by backwashing, the pulsing action flexes them sufficiently to loosen adhering particles so that the cleaning action is more easily accomplished.

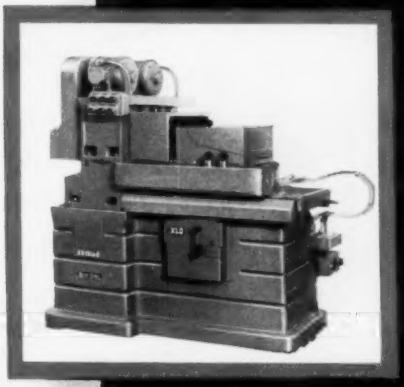
The dual manifold principle permits using smaller filter units with automatic self-cleaning and opposite cycling of the manifolds. While one manifold filters, the other is being backwashed.

The unit illustrated shows an additional set of skimmer flights for removal of foam created by extremely fine particle suspension. One set of chain-driven flights removes sludge from the bottom of the tank blown from the filter leafs during cleaning, and the smaller flights push the foam-borne contaminants to the ramp where they are carried away by the chain-driven flights from the bottom.

Circle Item 142 on postcard, page 195

(*Continued on page 216*)





A standard Style 112-D Precision Boring Machine equipped for Bor-Dril work.

Bor-Drilling on a standard 112-D Precision Boring Machine. This three-station set-up produces close-tolerance holes, smooth finish.

BOR-DRIL

PRODUCES .312-.313 DIAMETER PRECISION THROUGH HOLES IN 2½" SOLID METAL

THE PROBLEM: an auto manufacturer wanted to produce accurate, close-tolerance holes from the solid in small transmission parts without costly secondary operations.

THE SOLUTION: Ex-Cell-O Style 112-D Precision Boring Machines equipped for Bor-Drilling. These machines are Bor-Drilling .312"-.313" diameter through holes for a distance of 2½", three at a time in transmission range selector shaft.

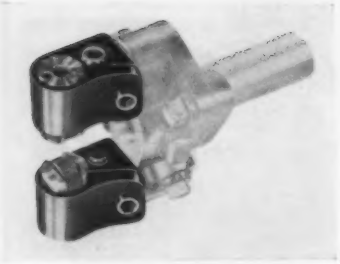
WHAT IS BOR-DRILLING? Bor-Dril is a new way of driving gun drills, adapted to high production-with-accuracy requirements. Bor-Drilling is especially effective when machining from the solid holes too long for single-tool boring applications, and holes in which it is difficult to maintain finish size. Bor-Drilling requires no secondary finishing operations in most cases. Ask your Ex-Cell-O Representative or write Ex-Cell-O, Detroit for Bulletin 311162 explaining all about Bor-Drilling.

Bor-Drilling turns out straight, accurate holes—such as these held to .312"-.313" diameter for 2½ inches.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

XLO
EX-CELL-O FOR PRECISION



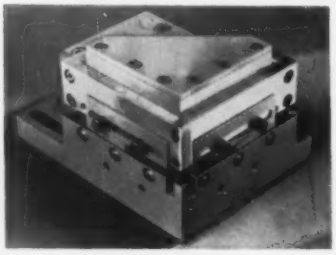
Knurling Attachment for R and L Turning Tool

Newly developed knurling attachment that converts R and L turning tools for knurling operations announced by R and L Tools, Philadelphia, Pa. With the addition of this accessory, the turning tool can produce either straight- or diamond-pattern knurling, the knurls being adjustable to any desired angle. One hexagonal wrench makes all adjustments and a set-screw locks the knurls securely. The knurls may be changed without removing the tool from the turret.

Circle Item 143 on postcard, page 195

Corner-Notching Unit by Wales-Strippit

New NA 3/4-inch 90-degree corner-notching unit with removable reversible punch and die blades announced by the Wales-Strippit Co., Akron, N. Y. Advantages claimed for this independent notching unit are short 3/4-inch dimension from cutting edge to outside face of unit that permits close positioning to other units in a setup; punch and die blades in two segments which can be interchanged, reversed, turned end-for-end and top-to-bottom to present eight cutting edges before regrinding is necessary; and fully guided self-stripping punch, permanently aligned with the die.

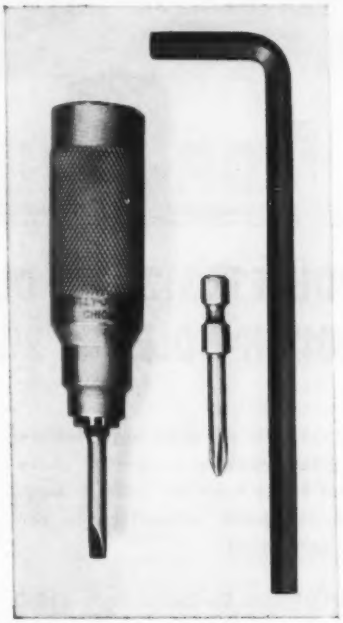


The notching units are made in 3-by-3-inch and 5-by-5-inch sizes, right- or left-hand, with or without adjustable-side gage-plates or built-in graduated gage table. Notching capacities are up to 1/8 inch thick in mild steel. Mounting can be done outside the press on mounting templates, T-slotted mounting plates, or rails. Nothing is fastened to the ram, which simply contacts a top punch-plate to depress the punch to the uniform 5 1/2-inch shut height. Four Strippit springs provide uniform stripping and lifting pressure. Each punch and die blade is in two closely machined and fitted parts to facilitate removal.

Circle Item 144 on postcard, page 195

Hand Screwdriver with Pre-Set Torque

"Safe-Torque" hand-operated screwdriver, developed by Scully-Jones & Co., Chicago, Ill. This screwdriver is designed for applications requiring a specified torque. Built to industrial standards with a roller-drive clutch in the range of 0 to 25 inch-pounds, it is ideal for precision assembly production and maintenance jobs where air- or electric-powered tools are either unavailable or cannot be used due to space requirements, safety regulations, etc. Typical applications include: industrial instruments, aircraft controls, missiles, appliance controls, and electronic equipment. The screwdriver is adjusted to maximum torque at the factory, with lower torques required by particular jobs being set by turning the adjusting screw counterclockwise. Each calibration on adjusting screw represents about 1 inch-pound of torque.



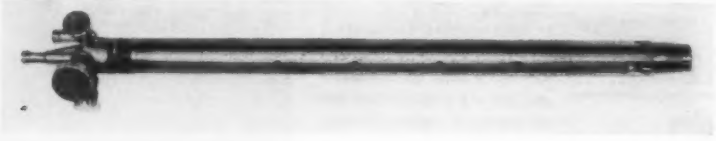
Circle Item 146 on postcard, page 195

(*This section continued on page 218*)

Machine Cutting Torches

A new series of Airco machine cutting torches, with both straight bore and divergent type cutting tips, is now available from the Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. This equipment is designed for use with natural gas, city gas, propane, and liquefied petroleum gases and will operate effectively under either low or positive pressure. Designated as Style 2500 machine cutting torches, there are two- and three-hose models. One model is for use on Travographs, Oxygraphs and Duographs (multiple-torch flame-cutting machines), and two models are for use on Radiagraphs, Camographs, Monographs, and pipe cutting equipment. The straight bore type tip (obtainable in seven sizes) is for cutting steel up to 16 inches thick, while the divergent type tip (with a range of eight sizes) is for cutting steel up to 8 inches thick.

Circle Item 145 on postcard, page 195



gage post, provide fine 100 to 1

LONG processing time is cut SHORT on the new *Electrically Controlled* KING

INTERDEPARTMENT MEMO
To – Scheduling
From – Expediting

OK to re-route #23. Bob gets all his jobs through faster now with that new King
Pete

Whether you set up on a long production run or a single "maintenance" job, you can *finish it better, faster, and at lower cost* on an all-new KING® Electrically Controlled Vertical Boring and Turning Machine.

. . . because the new KING has *Full Electrical Control* — with all controls conveniently located:

☆ ***YOU CUT CONTROL MANIPULATION TO A BARE MINIMUM AND SPEED SET-UP TIME.***

. . . because the new KING is *Powered for Productivity* — 40 and 50 H.P. on 30", 36", and 46" sizes; 75 and 100 H.P. on sizes 56" and up:

☆ ***YOU CAN OPERATE THE MOST ADVANCED MODERN CUTTING TOOLS TO THEIR FULLEST CAPABILITIES.***

. . . because the new KING has *Expanded Feed and Speed Ranges* — 24 pre-selective feeds from .0016 to .250 per revolution . . . 24 pre-selective speeds in any one of three standard ranges:

☆ ***YOU GET REQUIRED FINISH AND SPECIFIED TOLERANCES ALL THROUGH THE SET-UP.***

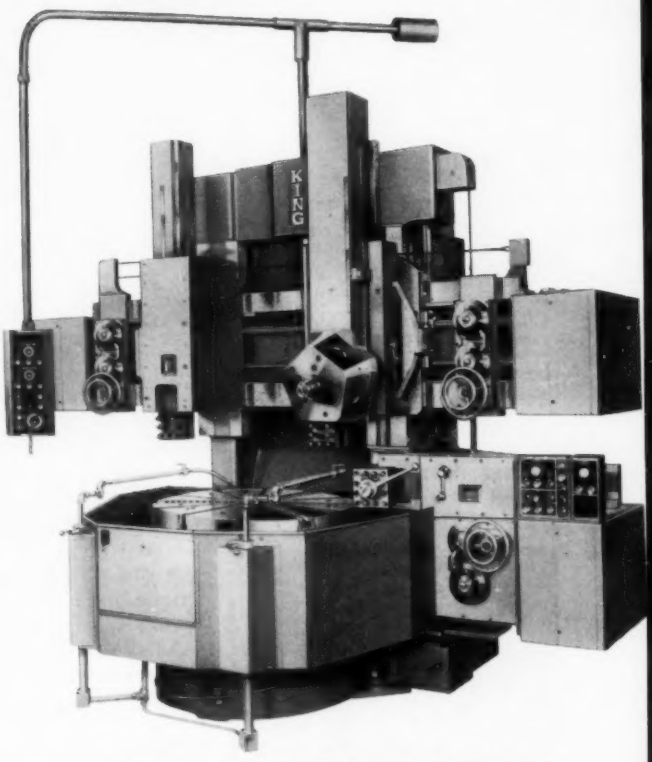
. . . because the new KING has an outstandingly improved spindle and spindle mounting:

☆ ***YOU GET MAXIMUM TABLE STABILITY WITH RESULTANT INCREASED AND UNIFORMLY MAINTAINED ACCURACY.***

. . . because the new KING is readily adaptable for addition of Optional Features such as *Automatic Cycling, Automatic Feed Stops, Automatic Tracing Control of Heads, Power Indexing of Turrets,* etc.:

☆ ***YOU HAVE BROADER TOOLING VERSATILITY FOR ATTAINING EXTRA-FAST AUTOMATED PRODUCTION AT MINIMUM COST.***

For complete details on Electrically Controlled KING Machines see the KING Distributor in your area or write us direct.



Machine illustrated is a 46" size with Ram Head and Turret Head on Rail, Side Head, and Complete–Unit Coolant Pan. Electrically Controlled King Machines are available in sizes 30", 36", 46", 56" and up, in a wide variety of head combinations, with or without side head.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

XLO EX-CELL-O FOR PRECISION

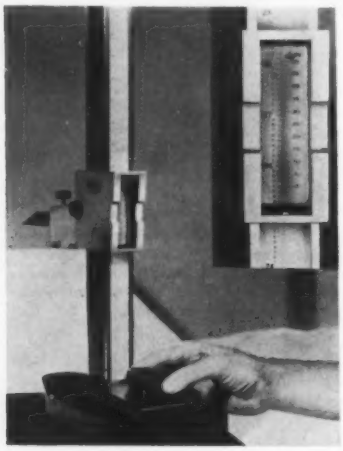
Chicago-Latrobe High-Speed Utility Drill

High-speed utility drill for portable use, designed to withstand considerable strain and operate successfully where full-length drills may fail. It is recommended for drilling truck and automobile bodies, sheet metal, and stainless steel, as well as for general-purpose drilling. Point is ground to eliminate "walking" when drilling sheet metal. Available in right- or left-hand fractional sizes of 3/64 inch through 1/2 inch and wire gage sizes 1 through 60 from Chicago-Latrobe, Chicago, Ill.

Circle Item 147 on postcard, page 195

Vernier Height Gage

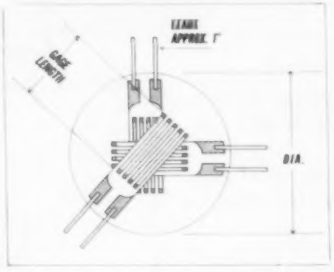
"Tumico Optic" vernier height gage introduced by the George Scherr Co., Inc., New York City. Machine divided and etched glass horizontal-reading scale and vernier can be read instantly in normal room light, eliminating all need for flash lights, magnifying glasses, and auxiliary lights. Parabolic chrome reflector behind scale reflects diffused light and shows large scale and vernier figures in sharp relief, assuring accuracy up to 0.001 inch. Single push-button frees jaw for initial adjustment, and convenient knobs, located on base and on top of gage post, provide fine 100 to 1 ratio adjustment. Lock knobs on either side of jaw provide for quarter-turn solid-locking of jaw to beam. Use of large vernier, approximately four times larger than standard, eliminates practically all possibility of misreading. Made in seven sizes from 18 to 84 inches.



Circle Item 148 on postcard, page 195

Super-Sensitive Strain Gage

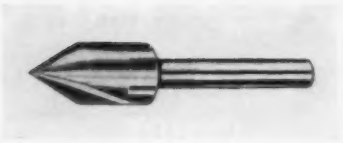
Diagram showing foil type rosette super-sensitive SR-4 strain gage developed by the Electronics and Instrumentation Division of Baldwin-Lima-Hamilton Corporation, Waltham, Mass. The rosette consists of three single-element foil gages individually insulated and mounted in Bakelite at 45 degrees to one another. Made in two sizes, 1/2 and 1/4 inch long, the rosettes permit pin-point analysis of stresses acting simultaneously along multiple axes having a common center. Foil gages, developed by B-L-H as an improved version of the familiar wire-filament strain gages, are said to exhibit greater accuracy and sensitivity, higher resistance to fatigue, and lower hysteresis.



Circle Item 149 on postcard, page 195

Carbide Tools

One of three new carbide cutting tools brought out by the Super Tool Co., Detroit, Mich., Division of Van Norman Industries, Inc. A chatterless, single-flute, solid carbide countersink, List No. CS, is now available in 3/8-, 1/2-, and 3/4-inch diameters, all with 1/4-inch, 82-degree taper shank. (Standard 60-degree taper is also available to order.) Single-flute, solid carbide center laps, List No. CL, are offered with 60-degree tapers in the same sizes as the countersinks.

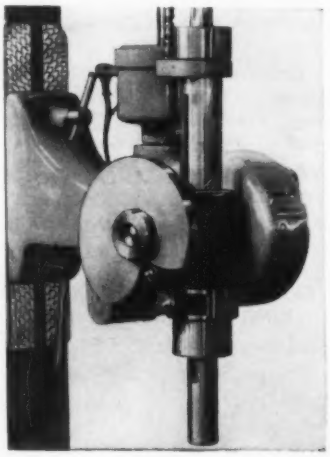


Circle Item 150 on postcard, page 195

Edlund Cam Feed for Production Drilling

Cam feed that is said to give maximum production at lowest cost, brought out by Edlund Machinery Co., Cortland, N. Y. This cam feed is externally mounted to the left side of the spindle-sliding arm. It controls the amount of travel, up to 3 3/16 inches including rapid advance and feed. The drive to the cam is supplied through a worm and worm-gear. This assembly in turn receives its input power from a gear train in a gear-case at the upper portion of the spindle. All gearing is mounted on ball bearings and runs in an oil bath. The feed cycle can be started by a push-button or foot-switch. The feed is engaged or disengaged through an electric direct-current magnetic clutch located in the worm-shaft. The cycle is automatically stopped at its completion by a limit switch. Electrical sequencing is easily provided with indexing devices or special fixturing.

Circle Item 151 on postcard, page 195



XLO EX-CELL-O FOR PRECISION

STYLE 22 QUILL-TYPE HYDRAULIC POWER UNIT*

STYLE 28-A HYDRAULIC POWER UNIT

IMMEDIATE DELIVERY

STYLE 20 HYDRAULIC POWER UNIT

57-74

Specify Ex-Cell-O standard power units and cut your machine tool lead time

Today's demand for increased productivity, lower per-unit cost, even on relatively short runs, is being met economically by automatic, single-purpose, high-production machines—consisting essentially of a plain base and one or more Ex-Cell-O Quill-Type Hydraulic Power Units. Their flexibility allows them to be used over and over again, spreading their initial cost over many productive years.

These standard, self-contained Ex-Cell-O Hydraulic Power Units are now being used for: drilling, counterboring, spot facing, reaming, as well as prime movers for milling equipment. With multiple spindle head attached to quill flange, multiple operations may also be performed.

For the full story on the cost-saving advantages Ex-Cell-O Self-Contained Power Units offer your short- or-medium-run production requirements—get in touch with your local Ex-Cell-O Representative. Or, if you prefer, write direct to Ex-Cell-O, Detroit.

*Style 22—8-inch Stroke; Style 22-L—12-inch Stroke

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

VERS-O-TOOL cuts 10.3 miles of thread per grind on this job . . .

The Federal Screw Works had a real problem in threading. They had received a large order for 1"x13" adjusting screws. Using most thread cutting methods this would be a big, costly assignment.

Federal put a Namco 1⅝" DR Vers-o-Tool on the job and as a result, found they had to grind the chasers only once for approximately 2000 pieces. This means that each grind cuts well over 10 linear miles of thread. Threading cost per piece was amazingly low.

Remember, Vers-o-Tools can be used with your present turning equipment, lathes, drill presses or automatics. No investment in special machines required.

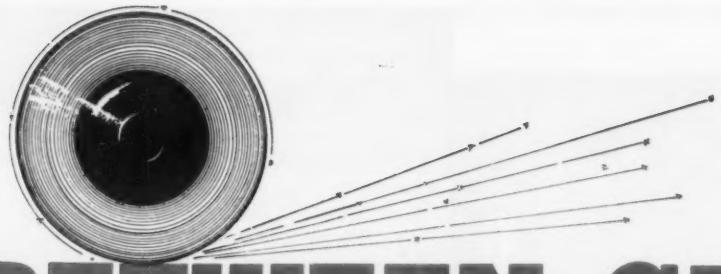
Find out how you can put Vers-o-Tools to work reducing your thread cutting costs. Write for a free copy of Booklet DT-52.

You can grind and regrind Vers-o-Tool circular chasers to a full 270° of the chaser circumference.

See Vers-o-Tools demonstrated at the A. S. T. E. Tool Show in Philadelphia, May 1-8, Booth #2115

National Acme

THE NATIONAL ACME COMPANY, 179 E. 131st St., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.



By E. S. Salichs

BETWEEN GRINDS

The Ballistic Makes Us Linguistic

A dawn course in basic Russian is being given on the General Electric television station, WRGB-TV, at Schenectady, N. Y., for the benefit of upstate New Yorkers, there being a heavy concentration of interested scientific personnel in upper New York State. Dr. Irving S. Bengelsdorf, of the General Electric Research Laboratory, is giving the course. The word *dawn* has a double meaning—throwing light on a language unknown to most Americans, and doing so at a very early hour in the morning, 6:30, to be exact.

Wayward Water

The Army's Engineer Corps is battling to keep the Mississippi River on course by erecting steel and concrete structures about 120 miles northwest of New Orleans, according to *Steelways*, in order to prevent vast economic damage. Old Man River, it seems, is bent on joining the Atchafalaya River, on a relentless drive to find a shorter route to the Gulf of Mexico.

Data from Dallas

A Navy fluoroscope has been tested at Chance Vought Aircraft, Inc., Dallas, Tex., for twenty months, and the verdict is that fluoroscopy in most cases can be substituted for radiography to check flaws in magnesium and aluminum castings, saving both time and money. For example, one casting cost 16 cents to inspect by fluoroscope and 80 cents by X-ray. In this report, we duly noted that the word fluoroscope was used fourteen times and never once spelled flouroscope. Our verdict, not only flaws checked.

Wink, Please

In *Wireco Life*, we read that a Japanese eye specialist who has studied over 20,000 eyelashes has predicted that in the future it will be possible to identify people by their eyelashes as well as by their fingerprints. But who wants to be plucked, particularly les girls. At least you don't lose your thumb when you are fingerprinted.

He Had a Good Day

An animated film, "It's All in the Cards," put out by the Association of American Playing Card Manufacturers to stimulate card-playing, shows a page from a notebook belonging to George Washington which contained a record of his card wins and losses. The tally on this particular page carries the notation, "Also crossed Delaware."

MACHINERY'S REPRESENTATIVE DOUBLES IN BRASS—Norman O. Wynkoop, Jr., one of our publication representatives, was recently on duty in his capacity of Executive Officer of the Detroit Navy Public Relations Unit, as he accompanied Rear Admiral F. S. Withington, Chief of the Bureau of Ordnance, Navy Department, on a tour of the General Motors Technical Center. Seen here examining Firebird, the second, the GM experimental jet-driven automobile, are (left to right): Lieutenant Commander Wynkoop; Dr. L. R. Hafstad, vice-president of General Motors in charge of research and development; Admiral Withington; Captain C. A. Keller, Commanding Officer of Naval Air Station in Detroit; and Commander Otis, Detroit Naval Reserve Ordnance.

STARRETT PRECISION MAKES GOOD PRODUCTS BETTER

No. 675 Heavy Duty
Dial Test Indicator with:
• Quick-positioning swivel post
• Swiveling indicator clamp
• Extra rigid construction
• Easy-reading, no-glare dial
• Satin Chrome finish on dial case, black bezel

New STARRETT DIAL TEST INDICATOR

Sets up in seconds . . . handles any gaging job

Typical of the wide utility of Starrett Dial Indicators and Gages is this new No. 675 Heavy Duty Dial Test Indicator. You'll marvel at how fast it can be set up . . . at the easy way it handles any gaging job on the bench or around machine tools.

Offering similar time and money-saving advantages is the complete line of Starrett High Precision-Low Friction Dial Indicators, featuring simple, interchangeable design. Available in 140 models in regular and *Nonshock* types including all four A.G.D. groups and long range models. Simplified construction and interchangeable design means greater accuracy, longer life and simplified maintenance with lower upkeep costs.

Get the whole story on Starrett Dial Indicators and Gages from your Industrial Supply Distributor. Call him for quality products, dependable service. Or send for Starrett Dial Indicator Catalog showing the complete line. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

VISIT BOOTH 1401—ASTE TOOL SHOW
BOOTH 642—SOUTHWESTERN METAL EXPOSITION

Starrett®

DIAL INDICATORS AND DIAL GAGES

World's Greatest Toolmakers

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

For more information fill in page number on Inquiry Card, on page 195

Special Taps

Ground Thread — American National Form

GENERAL

The following tables and formulae are used in determining the limits and tolerances for ground thread taps having special diameter or special pitch or both, unless otherwise specified. This table does not apply to the diameter and pitch combinations shown in March MACHINERY

LEAD TOLERANCE

A maximum lead error of plus or minus .0005″ in one inch of thread is permitted.

ANGLE TOLERANCE

Threads per inch	Error in Half Angle
4 to 5½ incl.	20′ Plus or Minus
6 to 9 incl.	25′ Plus or Minus
10 to 80 incl.	30′ Plus or Minus

FORMULAE

Max. Major Dia. = Basic plus A
Min. Major Dia. = Max. minus B
Max. Pitch Dia. = Min. plus D
Min. Pitch Dia. = Basic plus C

In the above formulae:-

A = Constant to add:
35% of the theoretical truncation for 4 to 5 threads per inch
40% for 5½ to 12 threads per inch
45% for 13 to 80 threads per inch
To nearest .0005″ for 8 or more threads per inch and to nearest .001″ for less than 8 threads per inch

B = Major diameter tolerance
C = Amount over basic for minimum pitch diameter
D = Pitch diameter tolerance

NOTE: When the tap major diameter must be determined from a specified tap pitch diameter, the maximum major diameter equals the minimum specified pitch diameter *minus* constant C, *plus* the basic National single thread height, *plus* constant A.

VALUES FOR A, B, C AND D

Threads per Inch	A	B	C			D			
			To 5/8″ incl.	Over 5/8″ To 2½″ incl.	Over 2½″	To 1″ incl.	Over 1″ To 1½″ incl.	Over 1½″ To 2½″ incl.	Over 2½″
80	.0015	.0010	.0005	.0010	.0015	.0005	.0010	.0010	.0015
56	.0015	.0010	.0005	.0010	.0015	.0005	.0010	.0010	.0015
48	.0020	.0010	.0005	.0010	.0015	.0005	.0010	.0010	.0015
44	.0020	.0010	.0005	.0010	.0015	.0005	.0010	.0010	.0015
40	.0025	.0010	.0005	.0010	.0015	.0005	.0010	.0010	.0015
36	.0025	.0010	.0005	.0010	.0015	.0005	.0010	.0010	.0015
32	.0030	.0010	.0010	.0010	.0015	.0005	.0010	.0010	.0015
28	.0035	.0010	.0010	.0010	.0015	.0005	.0010	.0010	.0015
24	.0040	.0010	.0010	.0010	.0015	.0005	.0010	.0015	.0015
20	.0050	.0010	.0010	.0010	.0015	.0005	.0010	.0015	.0015
18	.0055	.0010	.0010	.0010	.0015	.0005	.0010	.0015	.0015
16	.0060	.0010	.0010	.0010	.0015	.0005	.0010	.0015	.0020
14	.0070	.0010	.0010	.0015	.0015	.0005	.0010	.0015	.0020
13	.0075	.0010	.0010	.0015	.0015	.0005	.0010	.0015	.0020
12	.0075	.0010	.0010	.0015	.0015	.0005	.0010	.0015	.0020
11	.0080	.0010	.0010	.0015	.0020	.0005	.0010	.0015	.0020
10	.0090	.0015	....	.0015	.0020	.0005	.0010	.0015	.0020
9	.0100	.0015	....	.0015	.0020	.0005	.0010	.0015	.0020
8	.0110	.0015	....	.0015	.0020	.0005	.0010	.0015	.0020
7	.0120	.0020	....	.0015	.0020	.0010	.0010	.0020	.0025
6	.0140	.0020	....	.0015	.0020	.0010	.0010	.0020	.0025
5½	.0160	.0025	....	.0015	.0020	.0010	.0015	.0020	.0025
5	.0160	.0025	....	.0015	.0020	.0010	.0015	.0020	.0025
4½	.0170	.0025	....	.0015	.0020	.0010	.0015	.0020	.0025
4	.0190	.0025	....	.0015	.0020	.0010	.0015	.0020	.0025

For intermediate pitches use value for next coarser pitch.

Extracted from "Standards and Dimensions for Taps and Dies" with permission of the publisher, Tap and Die Division, Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y.

Stove Bolt Taps

Cut Thread — Manufacturers Standard

THREAD LIMITS

Size	Threads per Inch S. B.	Major Diameter			Pitch Diameter		
		Basic	Minimum	Maximum	Basic	Minimum	Maximum
1/8	32	.1250	.1280	.1310	.1080	.1110	.1130
5/32	28	.1630	.1660	.1690	.1440	.1470	.1490
3/16	24	.1950	.1980	.2010	.1730	.1760	.1780
7/32	22	.2220	.2255	.2285	.1980	.2015	.2035
1/4	18	.2500	.2525	.2555	.2240	.2275	.2295
5/16	18	.3125	.3150	.3180	.2764	.2779	.2804
3/8	16	.3750	.3780	.3810	.3344	.3359	.3384
7/16	14	.4375	.4400	.4440	.3911	.3926	.3956
1/2	13	.5000	.5030	.5070	.4500	.4515	.4545

LEAD TOLERANCE

A maximum lead error of plus or minus .003″ in one inch of thread is permitted.

Straight Boiler and Staybolt Taps

Cut Thread — American National Form

THREAD LIMITS

Size	Threads per Inch National Form	Major Diameter			Pitch Diameter		
		Basic	Minimum	Maximum	Basic	Minimum	Maximum
1/2	12	.5000	.5010	.5040	.4459	.4464	.4489
9/16	12	.5625	.5635	.5665	.5084	.5089	.5114
5/8	12	.6250	.6260	.6290	.5709	.5714	.5739
11/16	12	.6875	.6885	.6925	.6334	.6339	.6369
3/4	12	.7500	.7510	.7550	.6959	.6964	.6994
13/16	12	.8125	.8135	.8175	.7584	.7589	.7619
7/8	12	.8750	.8760	.8800	.8209	.8214	.8244
15/16	12	.9375	.9385	.9425	.8834	.8839	.8869
1	12	1.0000	1.0010	1.0050	.9459	.9464	.9494
1 1/16	12	1.0625	1.0635	1.0675	1.0084	1.0089	1.0119
1 1/8	12	1.1250	1.1265	1.1310	1.0709	1.0714	1.0749
1 3/16	12	1.1875	1.1890	1.1935	1.1334	1.1339	1.1374
1 1/4	12	1.2500	1.2515	1.2560	1.1959	1.1964	1.1999
1 5/16	12	1.3125	1.3140	1.3185	1.2584	1.2589	1.2624
1 3/8	12	1.3750	1.3765	1.3810	1.3209	1.3214	1.3249
1 7/16	12	1.4375	1.4390	1.4435	1.3834	1.3839	1.3874
1 1/2	12	1.5000	1.5015	1.5060	1.4459	1.4464	1.4499
1 5/8	12	1.6250	1.6265	1.6320	1.5709	1.5719	1.5759
1 3/4	12	1.7500	1.7515	1.7570	1.6959	1.6969	1.7009
1 7/8	12	1.8750	1.8765	1.8820	1.8209	1.8219	1.8259
2	12	2.0000	2.0015	2.0070	1.9459	1.9469	1.9509

LEAD TOLERANCE

A maximum lead error of plus or minus .003″ in one inch of thread is permitted.

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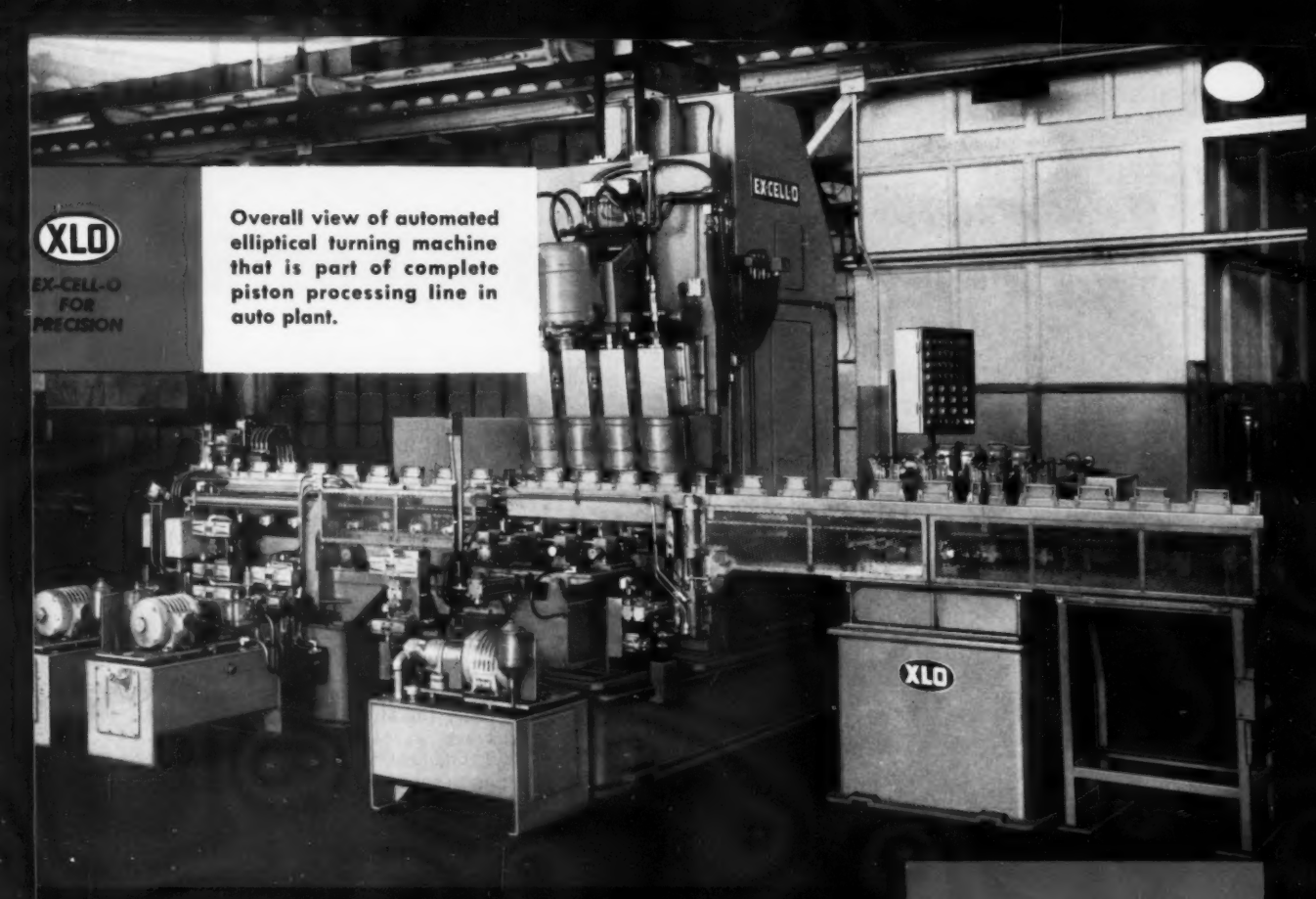
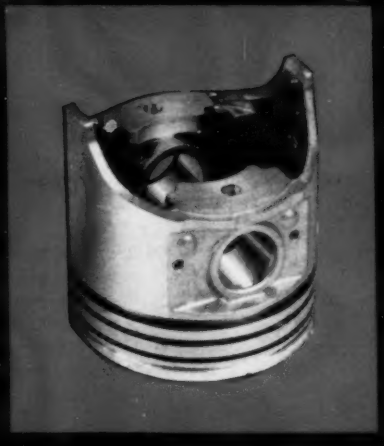


Overall view of automated elliptical turning machine that is part of complete piston processing line in auto plant.

Roughs and Finishes 250 Pistons per Hour



57-77

This automated Ex-Cell-O machine semifinish and finish turns an elliptical shape on automotive piston skirts at the net rate of 250 pieces per hour.

Pistons enter the machine from a conveyor, are radially located from their wrist pin holes and clamped on the ring land diameters. Four heads machine four piston skirts simultaneously. Air gaging follows the machining operation, after which pistons are ejected to another conveyor.

Write to Ex-Cell-O or contact your local representative for further information or a proposal.

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

News OF THE INDUSTRY

California and Arizona

J. V. NAISH was elected president of Convair Division of General Dynamics Corporation, San Diego, Calif., in February, to succeed GENERAL JOSEPH T. MCNARNEY on April 1. Mr. Naish, former executive vice-president of Convair, also was named a senior vice-president of General Dynamics. He will continue as a member of the Dynamics board of management.

J. V. Naish, new president of Convair Division of General Dynamics Corporation

B-H-S MACHINERY CO., San Francisco, Calif., has been named sales and engineering representative in the northern California area for the Michigan Tool Co., Detroit, Mich.

HUGHES AIRCRAFT CO., Culver City, Calif., has appointed JOHN W. BLACK plant manager of their Tucson, Ariz., operations. LOUIS L. REASOR, manager of service, has been named to succeed Mr. Black as assistant plant manager.

Illinois

GITS BROS. MFG. CO. (Pneumatics Division), Chicago, Ill., has announced two additions to its distributing organization: BARCLAY, AYERS, & BERTSCH, Grand Rapids, Mich., has been named exclusive distributor of the company's air line lubrication equipment for the western half of Michigan. GECO SALES, Los Angeles, Calif., is the new representative for this equipment in California.

SIZE CONTROL CO., Chicago, Ill., has set up a new gage department for the manufacture of special gages and precision parts in limited or production quantities. Special gages and parts can be produced with the extremely close tolerances of down to 5 millionths of an inch. Such close tolerances are often required in the manufacture and inspection of missile, rocket, and aircraft parts.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., announces that the general managers of two divisions have been elected vice-presidents of the company. CARL L. SADLER was elected vice-president of the Sundstrand Aviation Division, and RICHARD H. OLSON of the former Aviation Division at Denver, Colo., was elected vice-president in charge of the new Sundstrand-Turbo Division, which includes both the Denver operation and American Machine & Foundry Co.'s former Turbo Division at Pacoima, Calif.

WILLIAM F. FOWLER, JR., general manager of Thor Power Tool Company's Aurora, Ill., administrative offices, has been appointed to the additional position of manager of Thor branch operations. As branch operations manager, Mr. Fowler will coordinate all activities of Thor's network of branch offices.

VICTOR BROWN has been elected president and general manager of Kropp Steel Co., Rockford, Ill., a subsidiary of Kropp Forge Co., Chicago, Ill. Mr. Brown joined Kropp Forge in October 1942 as chief metallurgist, and was elected a vice-president in 1953.

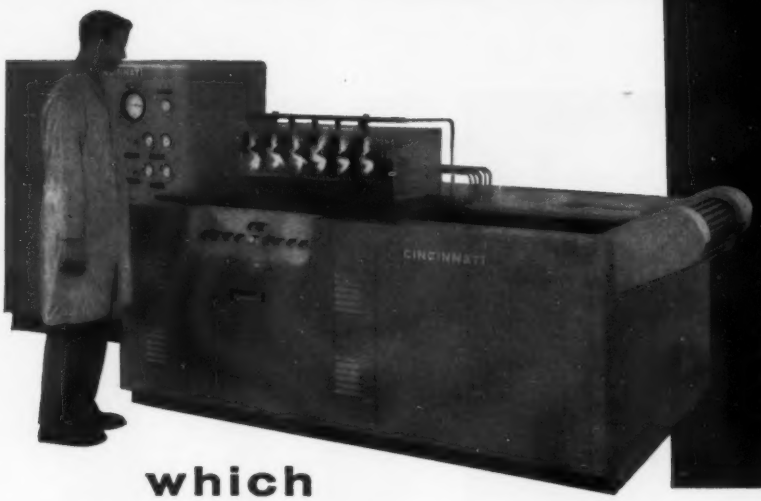
JOHN MENGEL has been appointed central district sales manager of H. J. Harper Co., Morton Grove, Ill. He previously held the positions of marketing sales engineer out of the home office and district manager of the company's branch office in Boston.

WILLIAM L. PARLON has been appointed sales manager of Onsrud Cutter Mfg. Co., Libertyville, Ill.

EDWARD T. MICHALEK has been promoted to assistant sales manager of the SpeedWay Division of Thor Power Tool Co., Chicago, Ill.

(Continued on page 228)

(Left) Carl L. Sadler, vice-president in charge of Sundstrand Aviation Division, and (right) Richard H. Olson, vice-president in charge of Sundstrand-Turbo Division, Sundstrand Machine Tool Co.



New CINCINNATI
flamatic®

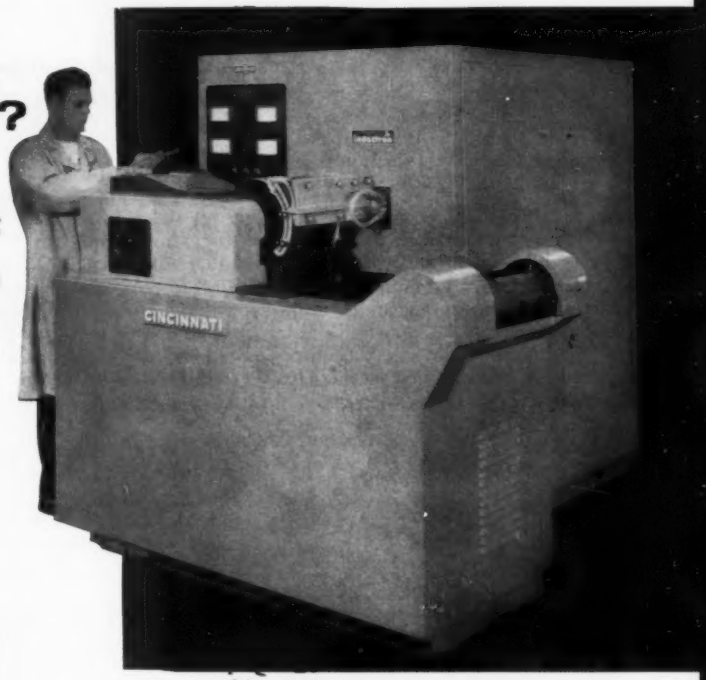
In production, the machine shown uses multiple fixtures for selective surface hardening *1000 automotive rocker arms per hour.*

which

CINCINNATI

meets your selective surface hardening needs?

Your product components that require heat processing—such as selective surface hardening, annealing, brazing, tempering—can be Cincinnati-processed at a savings! New and versatile Cincinnati flame or induction heating machines can do the work you specify—and meet your cost-per-piece requirements-on high production quantities or varied, small-lot runs. Let a Process Machinery Division field engineer evaluate your needs. With the assistance of our extensive research laboratories and engineering facilities, he is ideally equipped to recommend the heat source and method that will be best and cheapest for you.



See these two machines in operation, ASTE Show, Booth No. 1555, Philadelphia Convention Center, May 1 through 8.

New CINCINNATI
inductron®

This machine induction hardens both ends of *automotive push rods at the rate of 3600 parts per hour.*

CINCINNATI

flamatic and inductron
hardening machines

Meta-Dynamics Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

(Left) Robert T. Stafford, general manager, Seattle plant and (right) W. Raymond Lockwood, manager of Chicago machinery division, Joseph T. Ryerson & Son, Inc.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the appointment of ROBERT T. STAFFORD as general manager of their Seattle steel service plant. He succeeds W. RAYMOND LOCKWOOD who is appointed manager of the machinery division, with headquarters in the general offices in Chicago. ERNEST L. YOUNTS, former manager, was named machinery consultant.

ROY PROCHNOW was recently appointed assistant to the director of operations for Clearing Machine Corporation, a division of U. S. Industries, Inc., Chicago, Ill. Mr. Prochnow has been with this corporation for twenty years in the engineering and production departments. Since 1951 he has been factory manager.

Roy Prochnow, assistant to the director of operations, Clearing Machine Corporation, a division of U. S. Industries, Inc.

T. S. PACER has been elected executive vice-president of the Illinois Gear & Machine Co., Chicago, Ill.

Indiana and Michigan

H. & B. AMERICAN MACHINE CO., INC., Chicago, Ill., has announced the opening in January of a new Indianapolis, Ind., plant to inspection by Air Force and Navy procurement officers and aircraft manufacturers' representatives. The 110,000-square-foot plant was designed to meet special materials-handling and work-flow problems in the precision machining of wing spars, bulkheads and other large structural parts forged in high-strength alloy steel, aluminum, and titanium.

CHARLES E. PETERS has been appointed plant manager of the Beatty Machine & Mfg. Co., Hammond, Ind. Mr. Peters was previously associated with divisions of U. S. Industries, Inc., and the Hotpoint Co.

DAVID B. FOY has been appointed a field engineer by Norton Co., Worcester, Mass. He began his new duties at the Indianapolis, Ind., district office in March.

METALLURGICAL PRODUCTS DEPARTMENT, GENERAL ELECTRIC CO., Detroit, Mich., announces three district appointments: HARRY JASON, formerly manager of tool sales in Detroit and district manager of the New England and Midwestern districts, has been made manager of the newly organized Southern district. JOHN J. GALVIN, who was sales representative for the Atlantic district, succeeds Mr. Jason. Mr. Galvin's former duties will be assumed by ROBERT RENNIE, who has been appointed sales representative of the Atlantic district. JAMES M. STEVENSON has been appointed sales manager of vacuum-melted products.

PALMER-BEE CO. of Bloomfield Hills and Marysville, Mich., announces the formation of the Autocon Division to fabricate custom electrical control panels for conveyors and machine tools, and to design and engineer completely integrated electrical control systems.

DIXIE TOOL CO., Bridgeport, Mich., elected the following officers in January: ERNEST SWAINE, president and general manager; MILO SHANER, vice-president and assistant general manager; DONALD ALEXANDER, treasurer; and RAYMOND JOHNSON, secretary.

HANCOCK INDUSTRIES, Jackson, Mich., announces the establishment of a new operating concern, Control Systems Co. The new company will assume responsibility for the development, design and marketing phases of a unique electromechanical control and monitoring system, applicable to product manufacturing within most industries.

EDGAR D. LEON has resigned as president of Gear Grinding Machine Co., Detroit, Mich. WILLIAM F. WILSON, executive vice-president and general manager, has been named to assume the position.

F. R. CRUSE has been appointed sales manager for the Stainless Processing Division of Wall Colmonoy Corporation, Detroit, Mich.

New England

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., has announced the appointment of seven men to augment its nationwide sales force: M. A. WINTER has assumed responsibility for a territory including Arkansas, Oklahoma, and the Texas Panhandle. ROBERT H. FLOODSTRAND has been appointed field engineer in the Chicago area. JOHN E. ALLEN has been added to the Chicago area sales force. DANIEL M. VLAUN, JR., has been assigned the metropolitan New York City area. GERALD A. CURYLO has joined the Bay State sales force. ARNOLD D. JOHN has joined the Philadelphia area force, and JOHN G. BERG has been made salesman in the New England area.

LOOK

Here's your answer to machining "Superalloys"

VR-73

A Superior Steel-Cutting Cemented Carbide

- **Hardness: 92.0 Rockwell "A"**
- **Transverse Rupture Strength: 225,000 psi**
- **Density: 11.68 gms. per cc.**

VR-73—the newest V-R high quality steel-cutting carbide—combines higher edge strength with greater resistance to heat and abrasion—qualities never before available.

Outstanding for all types of general semi-finish and finish machining of the high tensile, high heat-resistant alloys—the superalloys—for missiles, rockets and jet engines!

Maximum performance is assured by its composition, grain structure and exceptional purity. Vascoloy-Ramet's exacting quality control procedures always make a constant, superior, uniform product.

For complete information, call your local V-R representative or distributor.

VISIT OUR BOOTH '58 ASTE TOOL SHOW

Booth No. 1035

MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS, AND TANTUNG® CAST ALLOY CUTTING TOOLS

V-R

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

890 Market Street • Waukegan, Illinois

C-656

Herbert H. Upton, general manager, Hydraulic Division, Brown & Sharpe Mfg. Co.

BROWN & SHARPE MFG. CO., Providence, R. I., has announced formation of a new organizational unit, to be named the Hydraulics Division. This new division combines three previously independent business activities—the company's former Hydraulic Products Division in Providence, R. I., the Double A Products Co., located in Manchester, Mich., and the power unit portion of the Rosaen Co., Hazel Park, Mich. The operation will be headed by HERBERT H. UPTON, serving as a general manager. Mr. Upton also continues in his former capacity as president of the Double A Products Co.

WILLIAM GLYNN, assistant to the factory manager, The Bullard Co., Bridgeport, Conn., has been appointed to coordinate a program of customer Machine Rebuilding. This program affords the company the opportunity of offering customers and users many advantages when rebuilding their present Bullard machine tools.

EMHART MFG. CO., Hartford, Conn., has elected WADE H. SHORTER, JR., vice-president. He is former general manager of the company's research, development and engineering operations. JOHN W. MURRAY, formerly assistant manager of the department, has been named manager.

PRODUCTO MACHINE CO., Bridgeport, Conn., has announced the appointment of an additional distributor in Southern California—MACHINISTS' TOOL & SUPPLY CO., Los Angeles, Calif.

New York

J. J. LINCOLN, JR., Air Reduction Sales Co.'s vice-president—southern region, Houston, Tex., has been appointed president of Pure Carbonic Co., New York City, a division of Air Reduction Co., Inc., also of New York City, effective as of March. He will be succeeded by J. H. KEENEY in Houston. Mr. Lincoln succeeds E. R. LAWRENCE, who has become chairman of the Pure Carbonic Division. L. T. D. BERG, assistant marketing manager-equipment of Air Reduction Sales Co., succeeds Mr. Keeney as marketing manager-equipment.

FRANK G. HELANDER has joined the Loewy-Hydropress Division of Baldwin-Lima-Hamilton Corporation, New York City. He was formerly manager of the Hydraulic Press Division of Birdsboro Steel Foundry & Machine Co., Reading, Pa., and executive vice-president of the Watson-Stillman Co., Roselle, N. J.

ALBERT R. COOK has been appointed as a market development engineer for the American Zinc Institute, Inc., New York City. Mr. Cook was formerly sales development engineer for Northern Aluminium Co., Ltd., one of the largest manufacturers of semi-fabricated aluminum parts in the United Kingdom.

VOLKERT STAMPINGS, INC., Queens Village, L. I., N. Y., have made additions to their executive staff: FRANK H. MCCROHAN, who has joined the company as assistant to the plant manager, and J. RANDOLPH SCHUMACHER, who has been named sales engineer.

ROBERT S. ROOT has been appointed chief engineer of both Clutch and Machine Tool Divisions of Lipe-Rollway Corporation, Syracuse, N. Y.

JAMES A. ERDLE has been appointed chief engineer by Johnson & Hoffman Mfg. Co., Mineola, N. Y.

Ohio

FRANK W. BROWNE has been appointed district manager, West Coast territories (California, Oregon and Washington), of the Warner & Swasey Co., Cleveland, Ohio. Mr. Browne has been with Warner & Swasey since 1945 and was graduated from the company's Apprentice Training Program.

FEDERAL MACHINE & WELDER Co., Warren, Ohio, manufacturer of resistance welding machines and Warco mechanical presses, has acquired control of the Berkeley-Davis line of automatic arc welding machines.

CINCINNATI GEAR CO., Cincinnati, Ohio, announces the election of PAUL W. CHRISTENSEN, JR., as its new president to succeed his father, P. W. CHRISTENSEN, who was elected treasurer and chairman of the board. Three vice-presidents were also elected: LESTER A. EDWARDS, for sales; ANTHONY J. LUCAS, for engineering; and WALTER L. RYE, JR., for manufacturing. P. W. Christensen is also president of the Cincinnati Steel Treating Co.

(Continued on page 232)

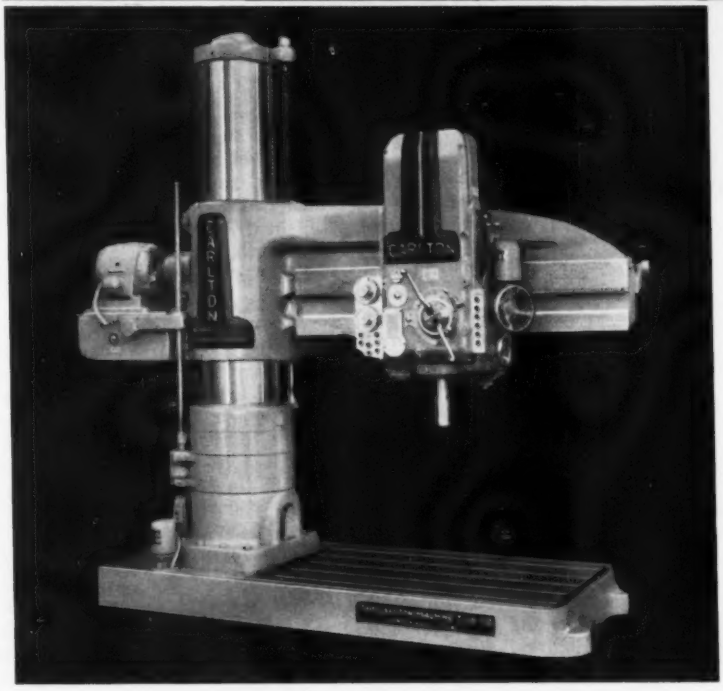
(Left) Paul W. Christensen, Jr., president, and (right) Paul W. Christensen, treasurer and chairman of the board, Cincinnati Gear Co.

Model	Column diameters	Arm lengths	Speeds No.	Speeds Range	Feeds No.	Feeds Range	Motor recommended
0A	9″	3′-4′	9	20 to 1	4	.006-.020	3-hp
1A	9″ 11″	3′-4′ 3′-4′-5′	12	25 to 1	6	.006-.025	5-hp 5 or 7½-hp
3A	13″ 15″ 17″	4′-5′ 4′-5′-6′ 5′-6′-7′	36	100 to 1	18	.004-.125*	7½, 10, 15, 20 or 25-hp
4A	19″	6′-7′-8′	36	100 to 1	18	.004-.125*	15 to 40-hp
5A	22″ 26″	7′ to 10′ 8′ to 12′	36	100 to 1	18	.004-.125*	20 to 40-hp†

*8, 11½, 14 and 18 threads per inch are standard, with various other combinations available.
† Driving motor larger than 40 hp can be used if desired.

Carlton . . . the modern design radial drill

0A 1A 3A 4A 5A



Only at Carlton can you take your choice of

- 5 different models of radial drills
- Column diameters from 9″ to 26″; arm lengths from 3-ft. to 12-ft.
- 5 different types of speed-feed controls (3A, 4A and 5A models)

For the utmost in versatility, you can choose the Carlton Programming System that lets you pre-set speeds and feeds for a complete drilling sequence of 20 or more operations.

For production operations involving fewer and less complex drilling sequences you can select from among three speed-feed controls that help make the machine more productive: Pre-select, Power range Pre-select and Partial Pre-select.

And in manual control, Carlton's simplified pushbutton control head is the most modern in design and easiest to operate.

There's no compromising at Carlton . . . where you select the radial drill that fits your requirements exactly. Write today for bulletins describing the sizes you need. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton *Specialists in radial drills*

PARKER-HANNIFIN CORP., Cleveland, Ohio, announces that the two divisions of the company which have specialized in the manufacture and sales of a wide range of rubber and metal seals for fluid systems, will be united in a single major organization to provide greater technical and sales attention for this rapidly growing part of the company's business. The name of the new division, which will combine present operations of Parker Rubber Division and the Franklin C. Wolfe Division, will be PARKER SEAL CO., Division of Parker-Hannifin Corp. Its headquarters will be in Culver City, Calif., under the direction of PAUL F. SMITH as general manager. SCOTT A. ROGERS, assistant general manager of the new division, will continue in Cleveland with direct responsibility for eastern operations. Cleveland will likewise be headquarters for T. J. MCCUISTION, sales manager of the new division, who was formerly sales manager of Parker Rubber Division.

NATIONAL ACME CO., Cleveland, Ohio, has announced the appointment of WILLIAM D. MARSHALL as assistant to Allan J. Park, product manager of the company's Electrical Manufacturing Division. THOMAS N. ANDERSON will replace Mr. Marshall in the Cincinnati area.

CARL F. STUGARD was elected a vice-president of Cincinnati Milling & Grinding Machines, Inc., sales subsidiary of the Cincinnati Milling Machine Co., Cincinnati, Ohio. He served in several capacities before being appointed manager of their Special Machine Tool Division.

Carl F. Stugard, vice-president of Cincinnati Milling & Grinding Machines, Inc.

FRANK J. PHILLIPS has been named vice-president and general manager of the Cyril Bath Co., Solon, Ohio. Mr. Phillips has been sales manager of the Bath Co. since 1952 and a director since 1956.

Pennsylvania and Maryland

WILLIAM F. BOYLE has been made general manager of BALDWIN-LIMA-HAMILTON CORPORATION, Hamilton Division, Hamilton, Ohio. He is a vice-president of the Philadelphia corporation. IRA MORGAN WHITE, chief engineer at Pelton Division, San Francisco, Calif., has been elected a vice-president of the corporation, and named to succeed Mr. Boyle as Pelton general manager.

E. E. SALOUM has been promoted to chief engineer of Snap-Tite, Inc., Union City, Pa., manufacturer of quick-connect couplings. Mr. Saloum is responsible for development, design, and testing of the company's line of special purpose quick-connect couplings.

C. GLEN BIGELOW, JR., has been appointed to the newly created position of director of research at Selas Corporation of America, Dresher, Pa. Mr. Bigelow's background is well suited for research.

JOHN S. WRIGHT, Philadelphia, Pa., is now exclusive representative for Kingsbury Machine Tool Corporation, Keene, N. H., in Philadelphia and the surrounding area, including Eastern Pennsylvania, Delaware, and all of Maryland except Garrett and Allegany Counties.

E. F. HOUGHTON & CO., Philadelphia, Pa., has completed additional plant and laboratory facilities in Detroit, Mich. Construction of the new addition more than doubles the original plant size.

CHESAPEAKE MACHINERY CO., Pasadena, Md., has been appointed sales and engineering representative in the Washington-Baltimore area for the Colonial Broach & Machine Co., Detroit, Mich. Territory will comprise the District of Columbia, the State of Virginia, and 15 counties of western Maryland.

Wisconsin

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., has announced plans for construction of new engineering, development, and research laboratories in Greendale, Wis. Among the projects to be carried out by the laboratories will be design, construction and testing models, mockups and prototypes of nuclear reactors, and associated equipment. The new facilities will be erected on a thirty-acre site in a one-story masonry, glass, and steel panel building.

ADAMAS CARBIDE CORPORATION, Kenilworth, N. J., has announced the appointment of CUTTING TOOLS, INC., Milwaukee, Wis., as an authorized Adamas distributor.

Coming Events

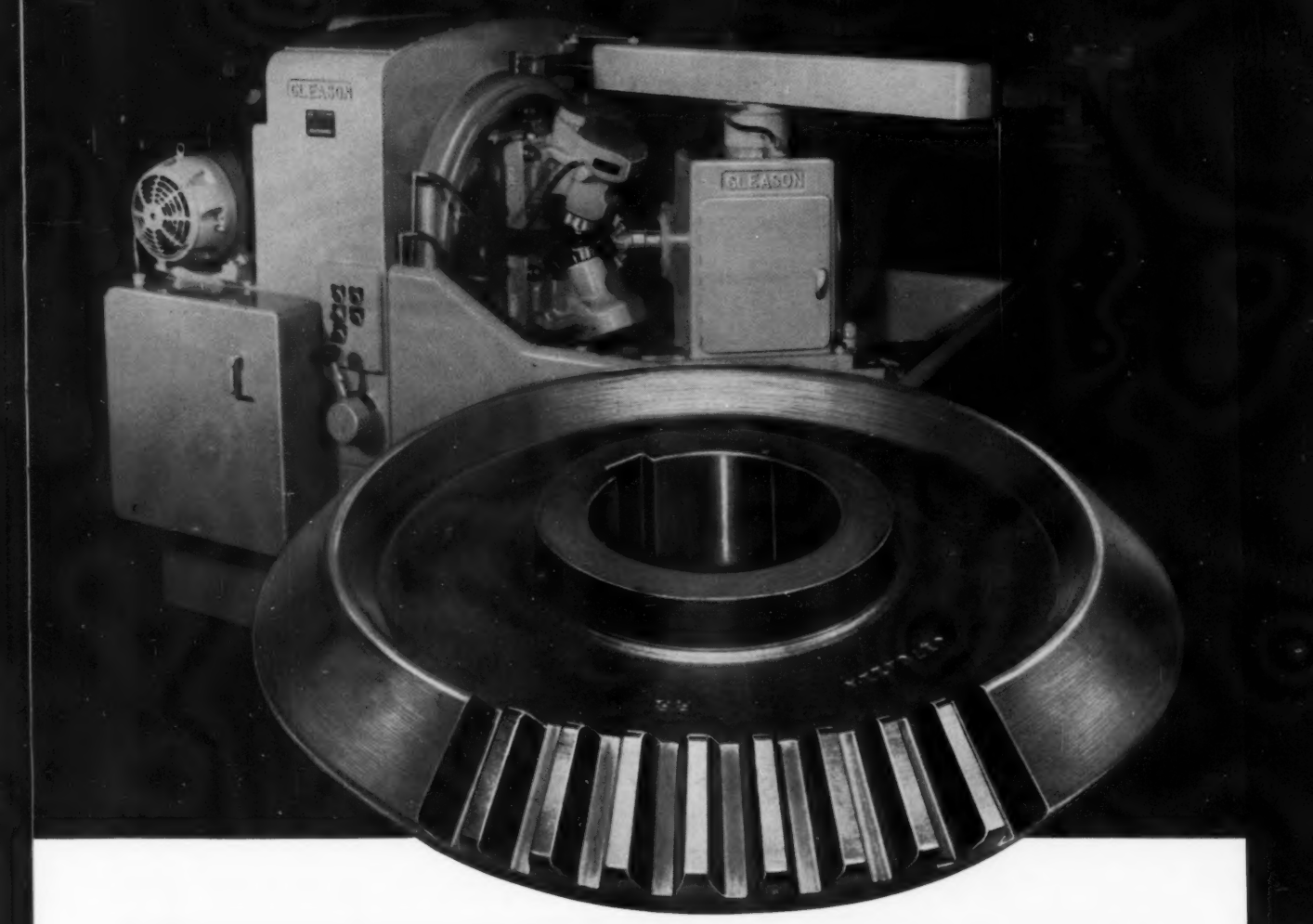
APRIL 14-17—Design Engineering Show and American Society of Mechanical Engineers' Design Engineering Conference will be held in the International Amphitheater, Chicago, Ill. For further information contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

APRIL 15-17—The American Welding Society will hold the sixth in the series of annual Welding Shows at Kiel Auditorium, St. Louis, Mo. The same week the Society will hold its annual technical meeting at the Hotel Statler, and an informal welding conference will also be conducted. Further information may be obtained by writing to Robert T. Kenworthy, A. W. S. Welding Show, 12 E. 41st St., New York 17, N. Y.

MAY 1-8—American Society of Tool Engineers' 1958 Tool Show and twenty-sixth annual convention will be held in Convention Hall Center, Philadelphia, Pa. For further information contact the Exposition Committee of the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.

MAY 12-16—Southwestern Metal Exposition and Congress, sponsored by the American Society for Metals, will be held at State Fair Park, Dallas, Tex. For further information contact the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. W. H. Eisenman, managing director.

JUNE 9-13—Fourth International Automation Exposition and Congress will be held in the Coliseum, New York City. For further information contact Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.



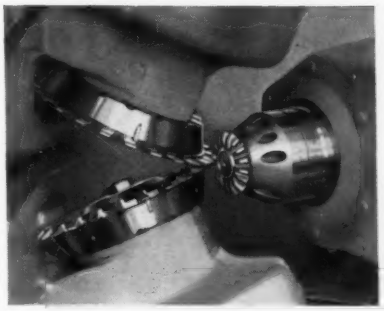
A complete gear for a fifth of a gear!

It all depends on the gear, of course. But, by the time an earlier model generator has cut one-fifth of a gear, the new No. 104 Straight Bevel Coniflex* Generator has *completed* a similar gear!

You can increase your production by as much as 400% with this new Gleason machine. You can get these results because this generator has two interlocking disc-type cutters with twenty-four blades each. These cutters complete a gear in *one rapid operation!*

But that is not all. The No. 104 is easy to set up—it has a wide range of capacity—it is excellent for small quantities or volume production. And, a new generating method insures high efficiency, fine finish, and maximum cutter life.

Write us and we will be pleased to send you a bulletin and further information on the new No. 104 Straight Bevel Coniflex Generator.



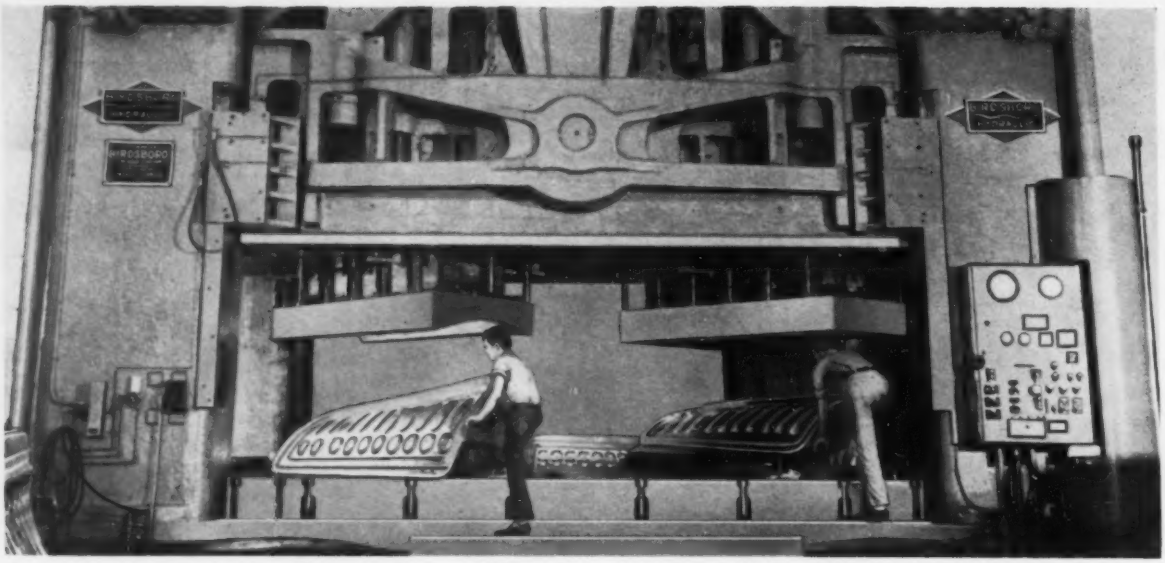
The No. 104 Straight Bevel Coniflex Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

*Coniflex® straight bevel gears with localized tooth bearing.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



design versatility—*the key to economy*

in hydraulic presses by **BIRDSBORO**

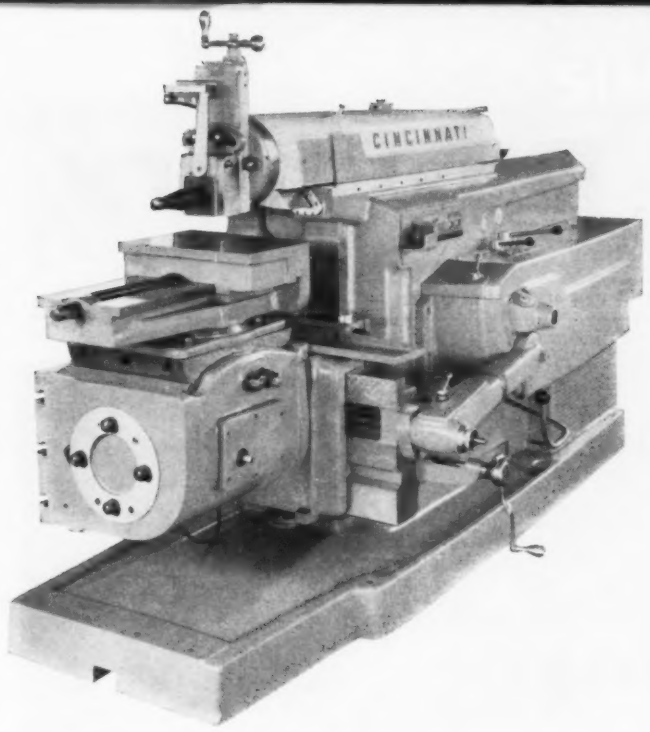
BIRDSBORO HYDRAULIC

• You can't afford a hydraulic press that cannot pay its way, and then some, in producing for today's market. As diversification and new methods change your production plans, presses with *advanced engineering* are the key to *versatility* that provides longer usable life. Birdsboro idea-power is geared to make your press everything you need for today, tomorrow and for much of the future. Ask your Birdsboro representative about it. *Main Office, Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

BIRDSBORO
STEEL FOUNDRY AND MACHINE CO.

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design • ROLLS: Steel, Alloy Iron, Alloy Steel

For more information fill in page number on Inquiry Card, on page 193



Cincinnati standard features: extra savings at no extra cost

Cincinnati Shapers give you so many money-saving features per dollar invested that they can be the most profitable equipment in your shop.

1. This 2″ cut, .030″ feed, demonstrates the ability of the 50 psi automatic lubrication system to maintain oil films under heavy leads.

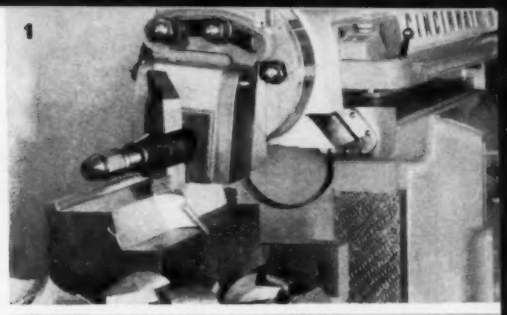
2. Brushless electromagnetic brake and clutch insure fast, easy operation. No adjustment is required.

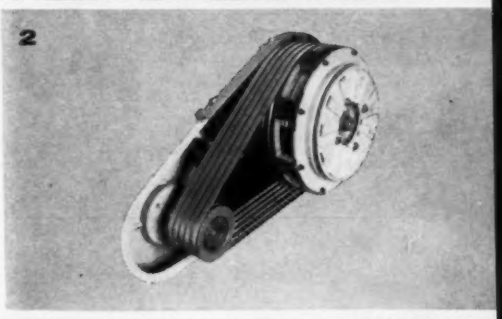
3. Both vertical and horizontal rapid traverse are standard Cincinnati features which substantially reduce setup and cutting time.

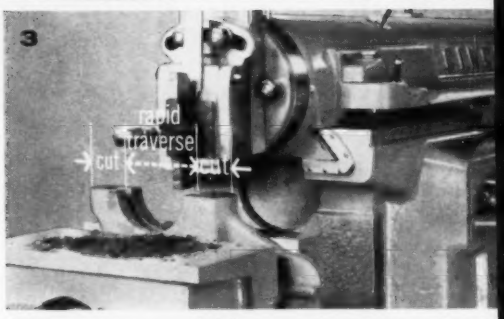
4. Extended ramway bearings increase ram support and minimize wear. Full table clearance to the column gets work closer to the column, minimizes overhang.

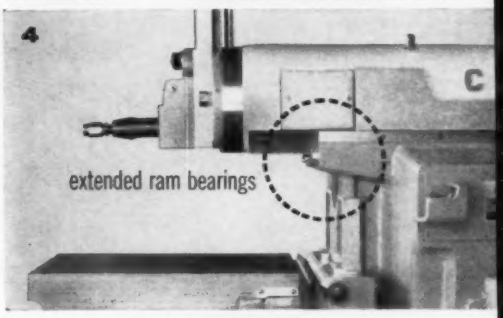
5. The vee ramways are integrally cast with the column. Ramway rigidity is increased by eliminating joints. Full length tapered gib provides for easy adjustment, maintains accuracy.

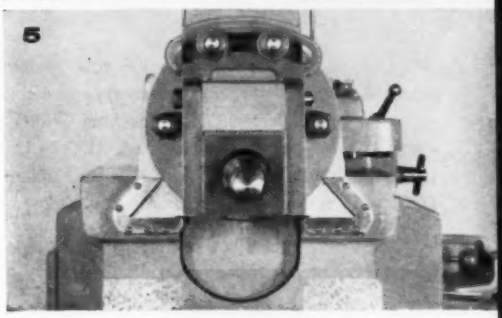
Write Dept. D for Bulletin "Cincinnati Rigid Shapers."











Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., Morton Grove, Ill.

ABRASIVES, Disc
Carborundum Co., Niagara Falls, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

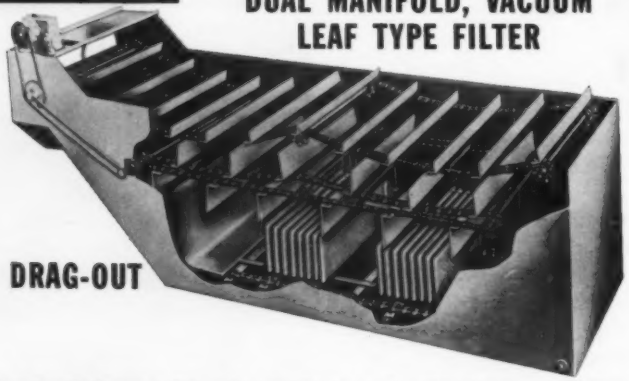
ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., Morton Grove, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

Filters Heavy Loads

Delpark Filter-Matic

DUAL MANIFOLD, VACUUM LEAF TYPE FILTER



WITH DOUBLE DRAG-OUT

• Developed to handle heavy solids volume and continuous filtering operation on wet type dust collectors. Leaf type filter elements have greater filter surface area, permit high filtrate flow. Two expeller flight systems remove foam borne contaminants and solids blown from filter elements during backwash. One manifold filters while the other backwashes.

Units available 5 to 1000 gallons per minute on water. Multiple units used on larger capacity requirements.

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Delpark

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Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
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Carpenter Steel Co., Reading, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
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ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

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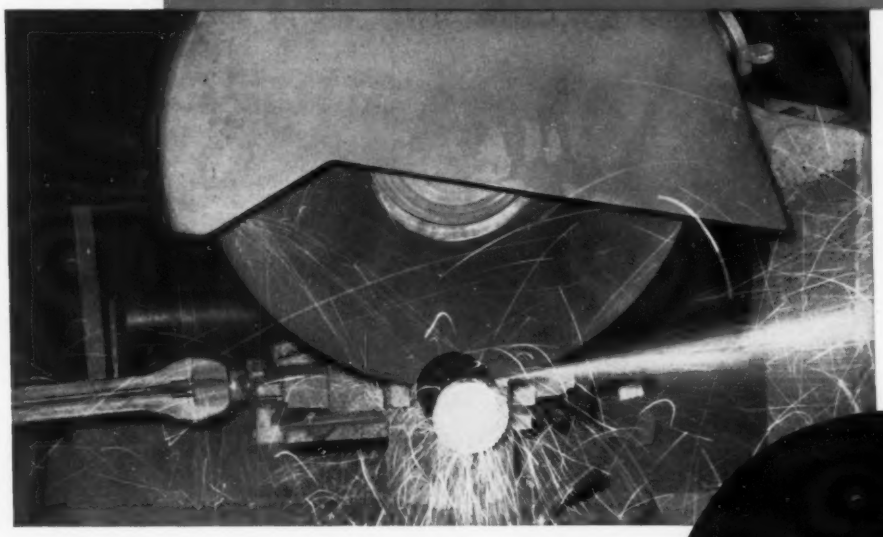
SIMONDS ABRASIVE CO.

RUBBER BONDED CUT-OFF WHEELS



WET *or* DRY *cutting with* FAST *and* SMOOTH *action*

High quality cut with good finish on ends! You can count on this with these wheels on cut-off jobs done wet, or even submerged—and on dry cutting where there is severe side strain. Wide range of grain and grade specifications. Diameter sizes include 10″, 12″, 14″, 16″, 18″ and 20″. Write for bulletin ESA 283.

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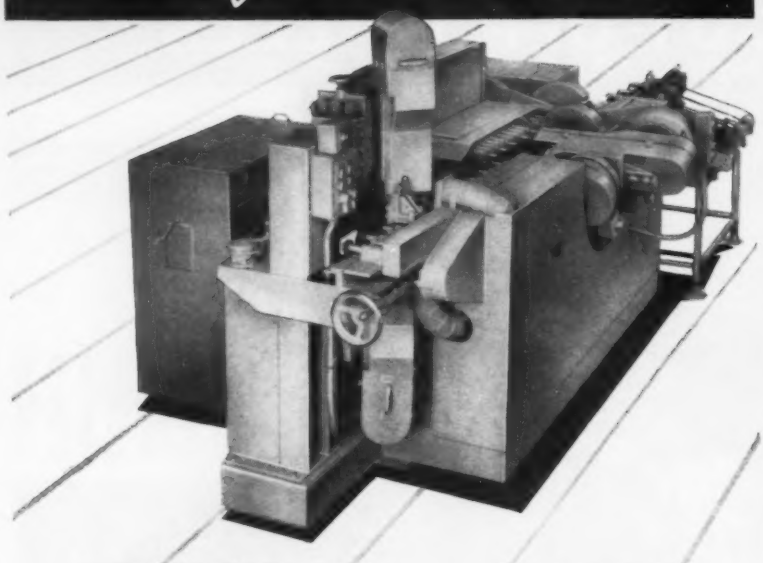
One machine "production line" by ENGELBERG!



6-1

This Engelberg Abrasive Belt Grinder Performs Six Operations in a Single Pass

Designed for IBM, this Engelberg abrasive belt machine grinds four sides of a typewriter carriage rack and deburrs milled slots on opposite sides in a single pass.

Powered feed rollers automatically convey the racks past the grinding and wire brush heads at thru-feed rates from 5-to-30 feet per minute. Grinding and wire brush heads are completely adjustable for angular orientation and depth of cut.

Automatic loading and stacking devices make this part of the production line a one-machine job, upping output and cutting costs.

• Special machines, as shown here are adaptations of standard models or custom-designed for a particular application. Let Engelberg methods-engineers study your drawings or sample for operational analysis. No cost. No obligation.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
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Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
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AUTOMATION EQUIPMENT

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Wilson Automation, P.O. Box 3855, Detroit 5, Mich.

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Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Haynes Stellite Co., Kokomo, Ind.
Hoover Ball & Bearing Co., Ann Arbor, Mich.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous

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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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NEW! from Erie Foundry Co.

Mechanical Forging Press

By eliminating the conventional pitman, Erie's new mechanical forging press is rugged, more rigid, and more compact. Guiding is unusual, too.

You are invited to see this press in operation at the Erie Foundry plant. Please call or write Mr. Claude L. Boring, General Manager, for an appointment.

Greatest name in forging machinery—Since 1895

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. . . now your distributor can supply **both**

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CAST or SINTERED BRONZE

Exact You can tell that a Bunting Bronze Bearing or Bar is a precision product. There is no sacrifice of care or skill in the low cost, big volume production of each of hundreds of different sizes. You can enjoy the economy of Bunting® Stock Bearings with complete confidence.

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Your Bunting distributor is listed in the classified section of your telephone directory usually under Bars—Bronze, and Bearings—Bronze. Two Bunting factories and eleven Bunting Branch Warehouses expedite distribution in all areas. Ask your local Bunting distributor or write for catalogs.

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BUSHINGS, BEARINGS, BARS, AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

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Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

BEARINGS, Needle
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio

BEARINGS, Oilless
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
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Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENDERS, Bar, Tube, Channel, etc.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

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at DE VILBISS

New design Brown & Sharpe Automatic Screw Machines

save up to 92% in production time

How much better production can you get from new design B&S Automatics? The De Vilbiss Company now has comparison figures on a wide variety of jobs transferred from old machines to new No. 00 Automatics. Each job shows production greatly increased over that obtainable with previous equipment. In many cases — one, two, and sometimes three secondary operations have been eliminated, ending the need for the extra machines previously required.

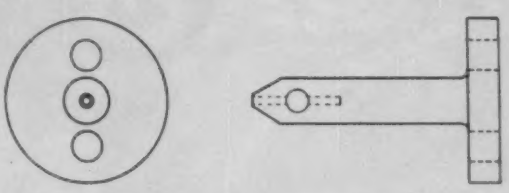
The man hour savings for some parts run as high as 92%. Along with these gains, the new No. 00 Automatics maintain the closest tolerances for size and concentricity, and meet the highest standards for surface quality.

Figure the comparable savings you can make, in your operations, with the extra speed, precision, adaptability — the easier setups and extended tool life you get with new-design B&S Automatics. You'll see why so many buyers say, "They pay for themselves, in record time." For complete details, write: Brown & Sharpe Mfg. Co., Providence, R. I.

Production time saved — 328 hrs.

Part	Quantity per run	Material
Nozzle Cleaner Body	18,560 pcs.	11/32" dia. Brass

With previous equipment	Production time — all operations	With new design No. 00
357 man hrs.	91% SAVING	29 man hrs.



on new B&S No. 00 Automatic with

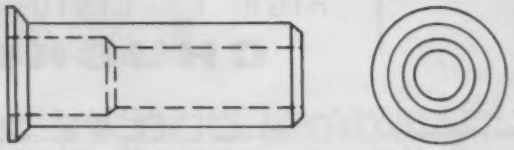
Special Offset Drilling Att. (2) Revolving Turret Drilling Att.
Cross Drilling Att. Spindle Brake Burring and Drilling Att.

Cutting RPM	Sec. per piece	Pieces per hr.
7200	10	360

Production time saved — 71 hrs.

Part	Quantity per run	Material
Valve stem tail piece	11,675 pcs.	21/64" dia. Brass

With previous equipment	Production time — all operations	With new design No. 00
77 man hrs.	92% SAVING	6 man hrs.



on new B&S No. 00 Automatic with

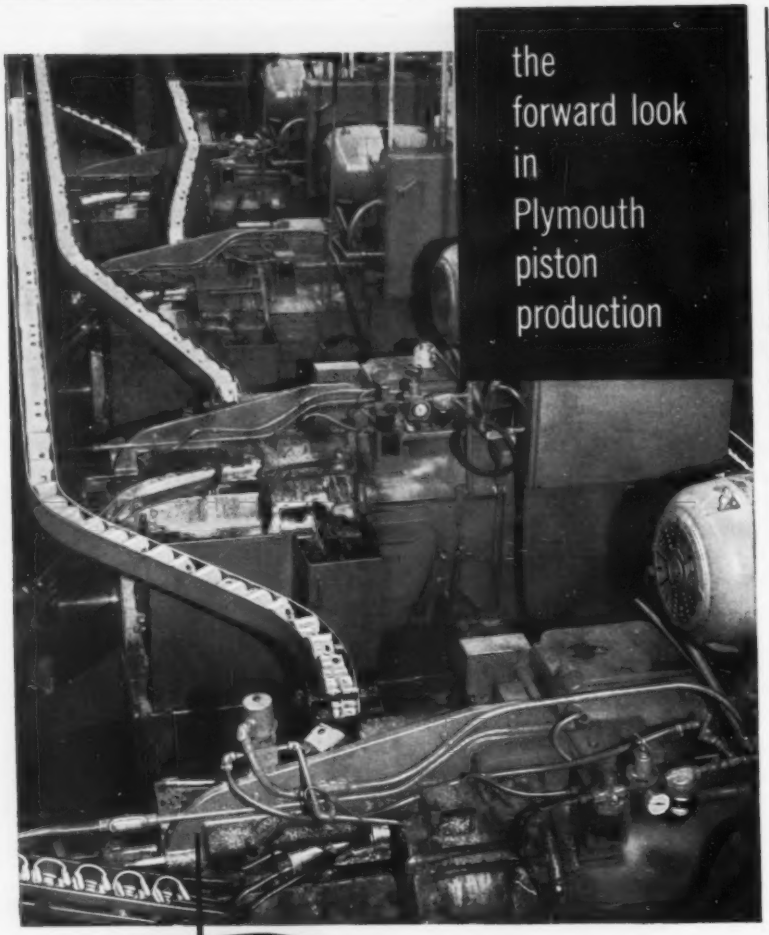
Burring and Drilling Att.

Cutting RPM	Sec. per piece	Pieces per hr.
7200	3½	1026

PROGRESS IN PRECISION FOR 125 YEARS

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES • MACHINE TOOL ACCESSORIES • PRECISION TOOLS • HYDRAULICS • CUTTERS



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COMPLETELY AUTOMATIC
HIGH PRECISION
CHUCKERS

Four Baird Model 76H Automatic Chuckers, at Chrysler Corporation's Mound Road Engine Plant, handle *all* Plymouth pistons on this new mechanized production line. They rough and finish two cuts on the O. D.; rough and finish ring grooves; rough and finish two cuts on the dome; chamfer skirt and dome; face to length. With auto load and unload, aluminum pistons are finished in 8 seconds.

Chrysler Corporation is a long-time Baird chucker customer. Chrysler engineers know that Bairds meet the requirements in machining speed . . . in close tolerance quality of work produced . . . and in freedom from down-time.

If you can use the exceptional capacity and low-cost productivity of Baird 6-spindle and 8-spindle chuckers, write Dept. M for more information.

THE BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

BAIRD
Six and Eight Spindle Chuckers • Automatic Multiple Transfer Presses • Automatic 12 Station Duplex Turning Machines • Vertical Continuous Lathes • Automatic Four Slide Machines • Hydroformers (Ribbon Metal Forming Machines) • Barrel Finishing Machinery • Machinery for Chain and Roller Chain Production, Garment Hook and Eye Production • Precision Spoon Presses

SBA58

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Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BENDING ROLLS
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT
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BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

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Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

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Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Kalon Div., Clifton, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

(Continued on page 244)

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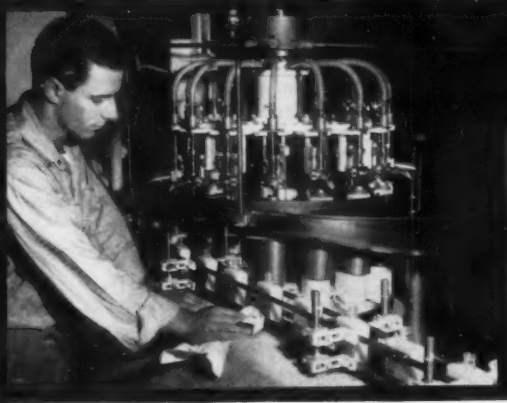
people buy Scott Wipers for many reasons:

Mr. Arthur Schute (right), Plant Manager at Revlon, says: "Scott Wipers are soft and absorbent, yet strong. We use them on production lines, filling lines, for cleaning ink from coding machines, for wiping oil and grease, and of course our employees use them for wiping hands and face."



Revlon saves $4,000 annually with Scott Wipers!

Revlon, Inc., at Passaic, N. J. has used Scott Wipers for about 15 months . . . for personal wiping, equipment wiping and miscellaneous clean-ups. Benefits: a high degree of sanitation in packaging operations and overall savings of $4,000 annually in wiping costs. Scott Wipers have eliminated the costs of cloth wiper distribution, collecting, sorting and laundering . . . are merely issued, used and tossed into handy receptacles.

SCOTT PAPER

Get the complete Revlon case history, with cost figures from your Scott distributor. He's in the Yellow Pages under "Paper Towels." Or write: Scott Paper Company, Dept. M-84, Chester, Pa.

Makers of the famous Scott paper products you use in your home. See "Father Knows Best" on NBC-TV.

NEW! *Two Cylindrical Die Type* THREAD ROLLING MACHINE

HORIZONTAL TYPE

Especially Suited for Job Shops

for Both In-feed and Thru-feed Rolling

The use of highly skilled setup and operating personnel is not required, because of the simplicity of operation and of change-over from one job to another. A cam-actuated head feeds the dies into the work and a fine micrometer adjustment provides for accurate final sizing. Can be used for manual, semi-automatic or completely automatic feeding.

Supplements widely used Reed cylindrical die thread rolling machines of the three die type.

DIAMETER CAPACITIES

In-feed - up to 2 inches

Thru-feed - up to ¾ inch

Write for Machine Bulletin B 111-1

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U.S.A.

Sales Offices In: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

TRM-168

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Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Canton Tool Mfg. Co., E. Canton, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wales-Strippit Co., Akron, N. Y.

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Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., 450 Fair Ave., Ferndale, Detroit 20, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

(Continued on page 246)

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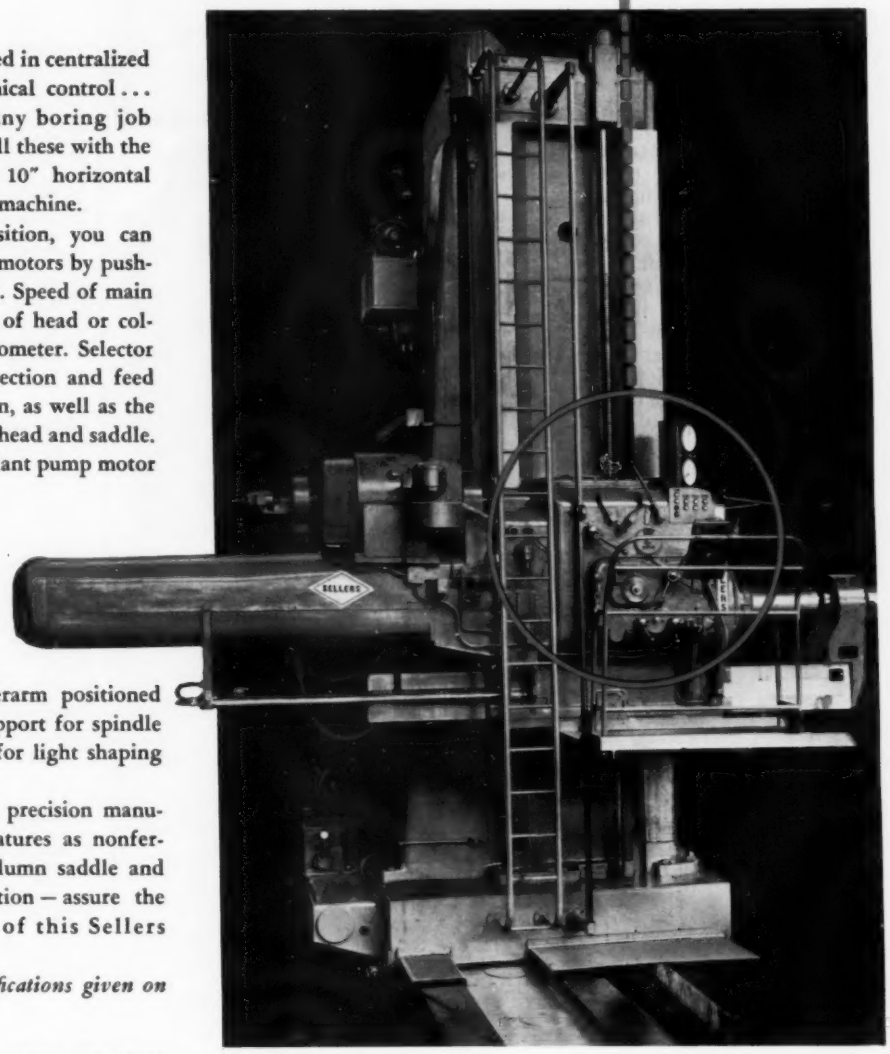
ACCURACY AT YOUR FINGERTIPS

in horizontal boring, drilling and milling

A new degree of ease and speed in centralized operation . . . positive mechanical control . . . outstanding accuracy for any boring job within its capacity! You get all these with the versatile Sellers® floor type 10" horizontal boring, drilling and milling machine.

From any convenient position, you can start, stop, reverse or jog all motors by push-button from a portable panel. Speed of main spindle motor and feed rate of head or column are adjusted by potentiometer. Selector switches control motion, direction and feed or traverse of head or column, as well as the clamping and unclamping of head and saddle.

Lubricating pump and coolant pump motor are controlled at the push-button station on the head. Selection of mechanical spindle-speed rate, feed rate and feed or traverse to spindle is by levers at the head.



Rectangular section underarm positioned hydraulically, serves as a support for spindle and attachments as well as for light shaping operations for keyways, etc.

Rugged construction and precision manufacture — including such features as nonferrous wear plates on the column saddle and bed of three-way construction — assure the never-varying accuracy of this Sellers horizontal.

Further details and specifications given on request.

CONSOLIDATED MACHINE TOOL DIVISION
FARREL-BIRMINGHAM COMPANY, INC.
Rochester 10, New York
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Consolidated®

SPECIFICATIONS

MAIN SPINDLE DIAMETER . . . 8" or 10"

SPINDLE STROKE . . . 72" to 96"

VERTICAL TRAVEL OF HEAD . . . 8' to 15'

HORIZONTAL TRAVEL OF COLUMN . . . 8' up

CM-29

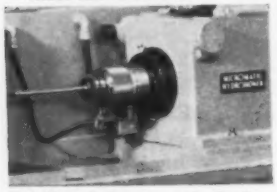
WHY "150" HYDROHONER

Reduces Costs . . .
Assures Controlled Finish . . .
Provides Rapid Stock Removal

To assure rapid stock removal and consistent generation of surface finish desired, the low-cost "150" Hydrohoner utilizes the distinctive Microhoning characteristic of self-dressing abrasives. Because abrasive grits are kept sharp-cutting at all times by a combination of controlled pressure and reciprocating-revolving motions of tool, a constantly high cutting efficiency is effected.

Basic "150" Hydrohoner —delivered from stock.

Microsize gage automatically ends cycle when exact size is reached.



Microdial automatic feed control and stone wear compensation.

Possessing a 12-inch stroke and a work diameter capacity of 1½ inches, the standardized "150" readily accommodates a variety of fixturing and tooling to assure easy adaption to a wide variety of work parts. Also, by addition of standard packaged units produced by Micromatic, it can be partially or fully automated.

Performing to the standards of higher-priced, special-purpose honing machines and incorporating features of a general-purpose design, the "150" Hydrohoner is an economical, long-range investment for long or short production runs.

Send Coupon for Complete Information.

Learn why Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____

TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____ J

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38 MICHIGAN

Gray, G. A., Co. 3611 Woodburn Ave., Cincinnati 7, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave. Cleveland 8, Ohio.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc. 42 Exchange Place, Jersey City 2, N. J
Snyder Tool & Engrg Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal Inc., Latrobe, Penna
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co. 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal
American Broach & Mch. Co., Ann Arbor, Mich.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface
American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE
American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

BURNISHING MACHINES
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

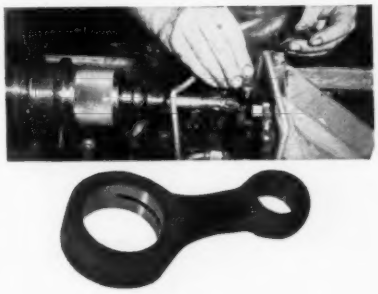
BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

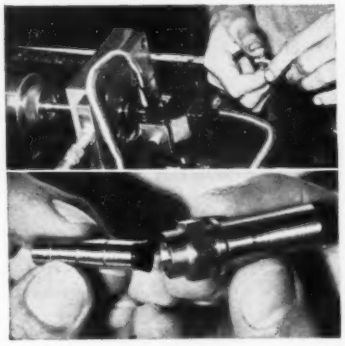
BUSHINGS, Non-ferrous and Powdered Metal
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

HOW Manufacturers Use "150" HYDROHONER To Reduce Costs...Control Finish... Obtain Rapid Stock Removal

Leading Manufacturers of precision parts are using the low-cost "150" Hydrohoner to secure high production, rapid stock removal, geometrical precision and controlled surface finishes. Indicative of the versatility for application of this highly efficient honing machine are the following recent installations:

The crankpin bore of a compressor connecting rod is Microhoned on a "150" Hydrohoner within tolerances of .00015" for taper, and .0002" for size and out-of-roundness. From .0008" to .001" of stock is removed from the bore (.875" diameter x .43" long) in about 8 seconds, while obtaining an 8 Microinch finish.





In this installation, a "150" is Microhoning in two runs the bore (.313" diameter x 1.375" long) of a braking cylinder. The first run removes between .004" and .006" of stock in 30 to 35 seconds. During finishing run, the final .0005" to .0008" is removed to provide geometric accuracy within .0002" tolerance and an 8 Microinch or better finish. Precision and controlled finish of bore prevent hydraulic oil leakage and minimize wear of neoprene-cupped piston.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ J

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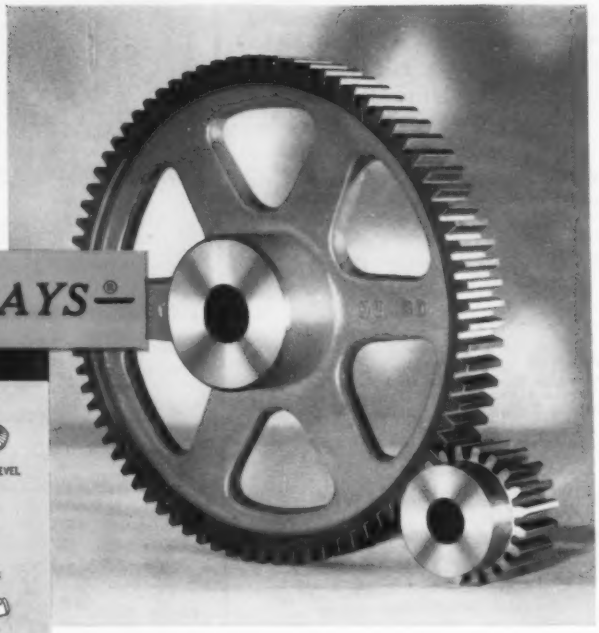

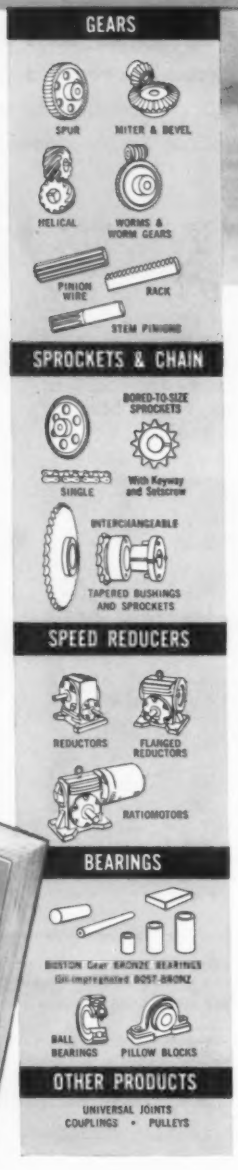

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Genuine ALLENs for your king-size holding jobs now available from stock!

1¼" and 1½" sizes are standard

These applications show you the great variety of holding jobs for which designers and engineers are specifying these rugged king-size Allen Hex-Socket Cap Screws. They're genuine Allens, from their heads to their Leader Points. Pressur-formd, to preserve the long fibers uncut throughout their lengths. Highly accurate threads. Leader Points, of course—for fast, true starting. 1¼" and 1½" diameters available immediately from stock—larger diameters are available on special order.

PHOTO: THE OILGEAR CO.

King-size Allen Hex-Socket Cap Screws are used to secure the flanges in this big 12-inch 3000 psi Oilgear Surge Valve.

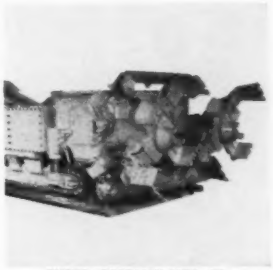


PHOTO: GOODMAN MFG. CO.

King-size Allens secure cutter arms, tilting arms, and elevating cylinders in this massive Goodman Continuous Mining Machine.

PHOTO: SODERHAMN MACHINE MFG. CO.

King-size Allen Cap Screws securely clamp the knives of this large and unusual machine that debarks whole trees.

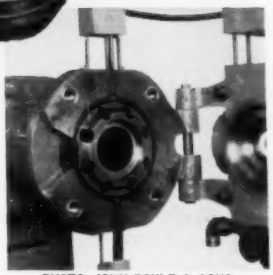
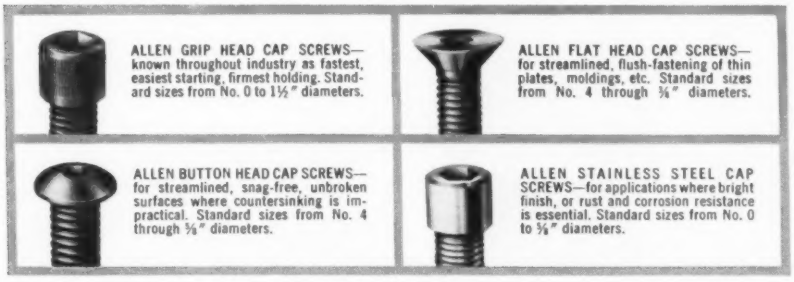


PHOTO: JOHN ROYLE & SONS

King-size Allens in the side-delivery Extruding Head of this Royle machine for application of rubber or plastic in solution.

The cost of Allen Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost saving advantages of genuine Allens!



ALLEN GRIP HEAD CAP SCREWS—known throughout industry as fastest, easiest starting, firmest holding. Standard sizes from No. 0 to 1½" diameters.

ALLEN FLAT HEAD CAP SCREWS—for streamlined, flush-fastening of thin plates, moldings, etc. Standard sizes from No. 4 through ⅜" diameters.

ALLEN BUTTON HEAD CAP SCREWS—for streamlined, snag-free, unbroken surfaces where countersinking is impractical. Standard sizes from No. 4 through ⅜" diameters.

ALLEN STAINLESS STEEL CAP SCREWS—for applications where bright finish, or rust and corrosion resistance is essential. Standard sizes from No. 0 to ¼" diameters.

FREE! . . . this new "vest-pocket" size Allen Hex-Socket Screw HANDBOOK . . . 112 pages of up-to-date technical information . . . Send for your free copy today.

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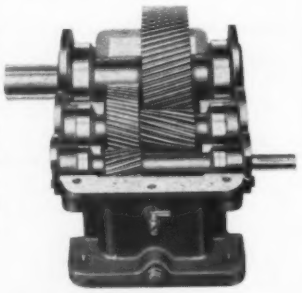
Wide range of large
H&S Speed Reducers
meets needs of
Webster Car Pullers

Here's a job that calls for rugged power and dependable gearing — pulling fourteen 75-ton railroad cars along a straight track, up a 1% grade, at a speed of 40 ft. per minute.

Webster Manufacturing, Inc., Tiffin, Ohio, easily solved this problem with the construction of a 50 HP Webster Car Mover. As part of this unit, Webster selected a Horsburgh & Scott Helical Gear Speed Reducer because it provided the necessary stamina for this high-torque job . . . unusually heavy bearings to withstand the greater overhung loads incident to car-puller operation.

From the same source — Horsburgh & Scott — Webster obtains the necessary extra heavy machine cut spur gears that drive the cable drum.



Seventy years of experience prove that *rugged construction* and *ample overload capacity* of H & S products assure trouble-free service and operating economy. Send us your requirements or contact your nearby H & S representative for prompt recommendations.

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Cleveland 14, Ohio

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die

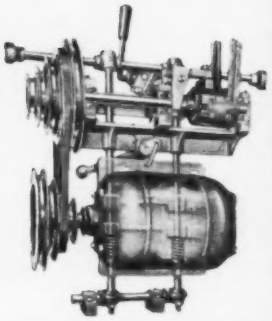
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

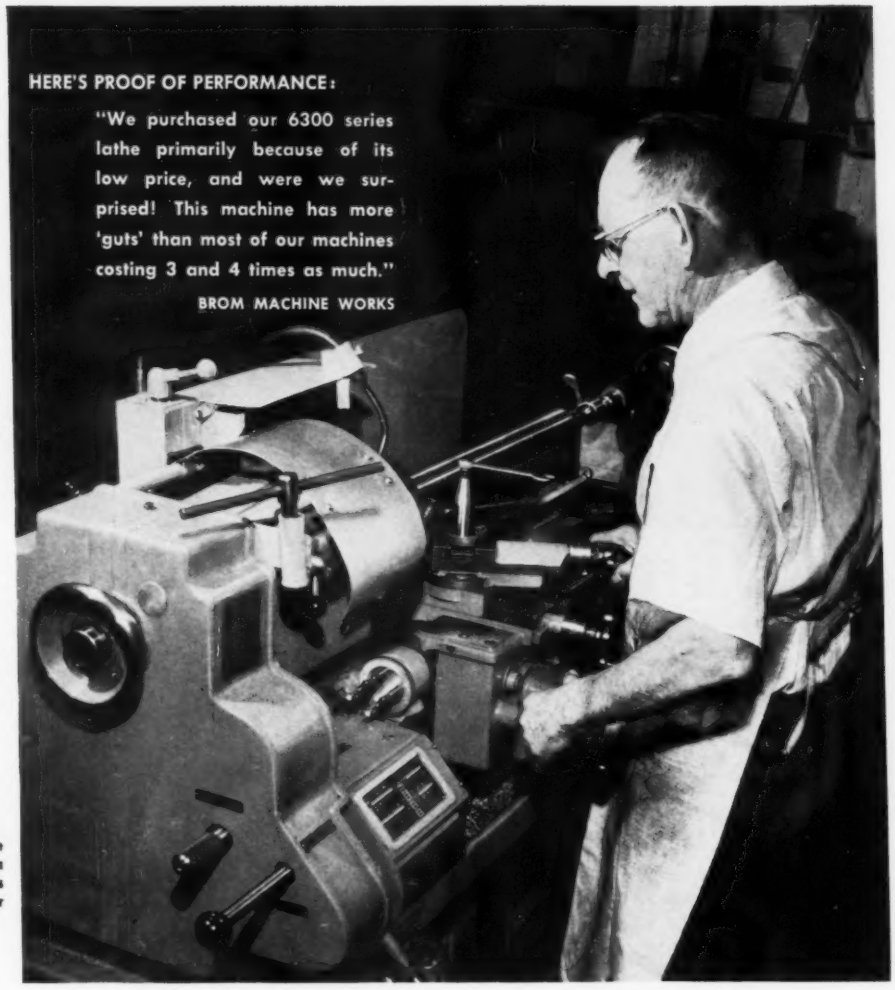
CASTINGS—Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.



Note heavy-duty construction of the 10-speed countershaft . . . the six ball bearings for smoothness and long service. Also available with heavy-duty variable speed countershaft.

Flame hardened bed ways are standard equipment at no extra cost — a feature that costs many dollars more in other lathes in the Clausing class.


HERE'S PROOF OF PERFORMANCE:
"We purchased our 6300 series lathe primarily because of its low price, and were we surprised! This machine has more 'guts' than most of our machines costing 3 and 4 times as much."
BROM MACHINE WORKS

BOUGHT on price—PRAISED for performance

"CLAUSING 6300 LATHE out-performs expensive machines"

The reaction of Brom Machine Works to the performance of their Clausing lathes is typical. It is not unusual for purchasers of Clausing lathes to get much more for their money than they had expected – Clausing 6300-series 12¾" lathes *do* set the standards for accuracy, efficiency and value in their price and capacity range. Here are a few of the reasons why.

Flame hardened bed ways are standard equipment *at no extra cost* on Clausing lathes. Headstock, apron and quick-change box are totally enclosed and gears and shafts travel in bath of oil – another important exclusive. Spindle is forged steel with 1⅝" bore, hardened and ground ASA – L-00 tapered key-locked nose. Spindle turns on Timken zero precision tapered roller bearings. Tailstock has No. 3 MT ram.

And superior performance is assured by more than superior features. Before it leaves the factory each Clausing lathe must pass rigid tolerance tests such as: spindle nose run out 0 to .0003" TIR, spindle taper run out at end of 12" test bar, 0 to .0006". The individual test report accompanying each lathe is an assurance it will machine with *dependable* precision. Compare *all* the features. Compare price. See for yourself why Clausing is acclaimed an outstanding lathe value – *the* lathe for *your* shop.

Write for free Literature

CLAUSING

CLAUSING DIVISION
ATLAS PRESS COMPANY
4-108 N. PITCHER ST. · KALAMAZOO, MICHIGAN

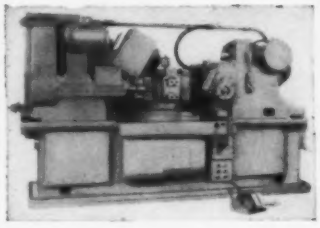
For more information fill in page number on Inquiry Card, on page 195

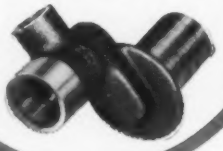
...and parts are finished without rehandling on

GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & De Leeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & De Leeuw and only Goss & De Leeuw offers this feature in a standard chucking machine.





A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY SERVICE

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

CEMENT, Abrasive Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTER-DRILLING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Improved Machinery, Inc., Nashua, N. H.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

(*Continued on page 254*)

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built to withstand rigorous service

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- ★ Exceptional Slide guiding and barrel type adjustment
- ★ Air Counterbalances on slide
- ★ Totally enclosed gears running in oil
- ★ J. I. C. Dimensions

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series **S1**
straight side single point presses

for drawing, forming, trimming or blanking.

capacities from 50 to 600 tons

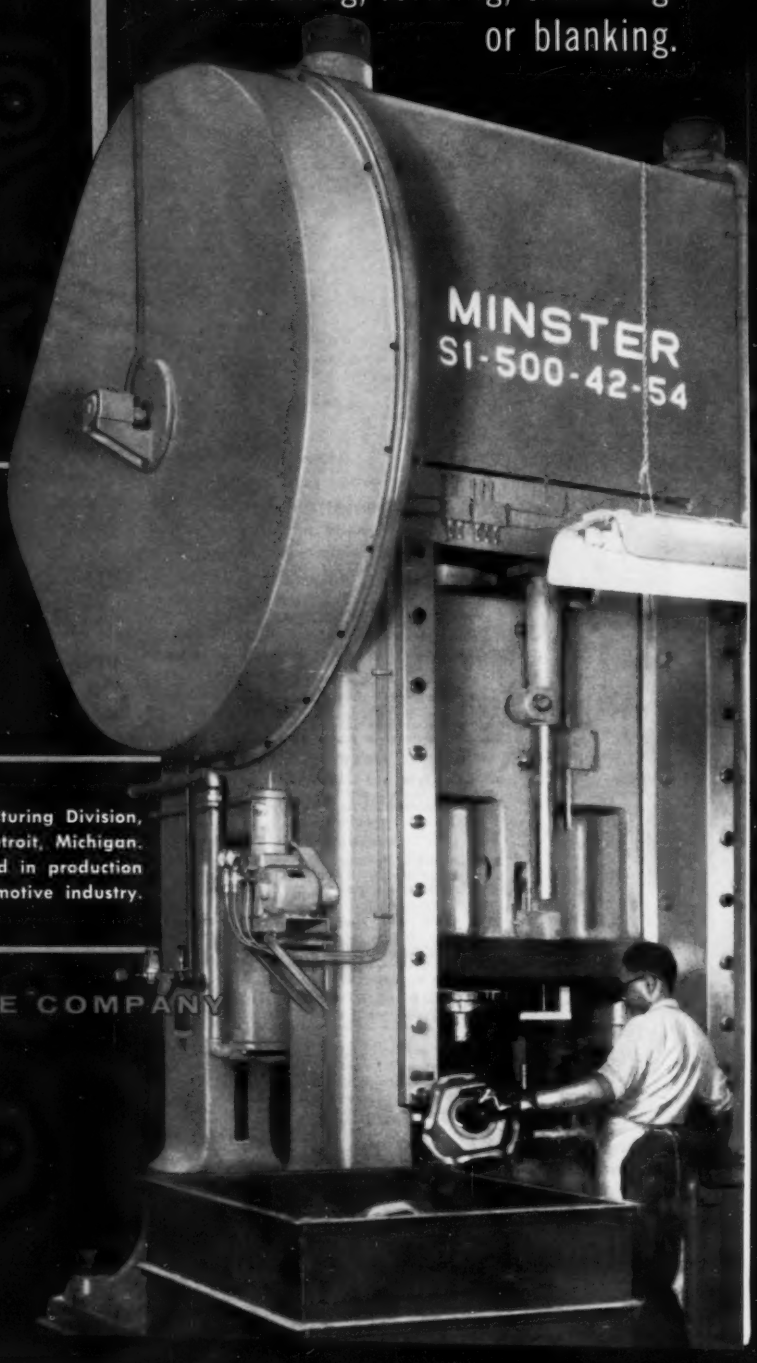


Photo courtesy of Long Manufacturing Division, Borg-Warner Corporation, Detroit, Michigan. Minster S1-500 Press used in production of clutch coverplates for the automotive industry.

THE MINSTER MACHINE COMPANY
Minster, Ohio

MINSTER®

MARVEL Synclinal FILTERS

are Standard Equipment

on this
GIANT SKYLIFT Model HR-250
by Automatic Transportation Co. of Chicago.

Capable of lifting a 25,000 pound load. It is especially designed to haul coils in steel mills. Marvel Synclinal Filters are installed as standard equipment.

Photo Courtesy Automatic Transportation Co. of Chicago

SUMP TYPE (Cutaway)

MEET J. I. C. STANDARDS

OVER 800
Original Equipment Manufacturers
are installing Marvel Synclinal Filters for dependable protection on machinery, mobile or stationary, utilizing hydraulic and other low pressure circulating systems.

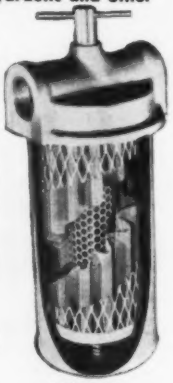
Marvel's *BALANCED* Synclinal Design offers Greater *ACTIVE* Filtering area plus Greater *STORAGE CAPACITY* for filtered out particles—RESULT—*LOWER PRESSURE DROP* over prolonged periods of operation.

A SIZE FOR EVERY NEED
Available for either Sump or Line installation in capacities from 3 to 100 G.P.M. (Greater capacities may be obtained by multiple installation as described in catalog. Choice of mesh sizes range from coarse 30 to fine 200.

EASY TO CLEAN
Both Sump type and Line type are easily disassembled, thoroughly cleaned and reassembled, on the spot in a matter of minutes. Line type may be serviced without disturbing pipe connections.

IMMEDIATE DELIVERY
Catalogs contain complete engineering data and dimensional charts making it easy to order a filter for your specific requirements and get Immediate Delivery.

Write, wire, phone or use coupon below.



LINE TYPE (Cutaway)

VISIT OUR EXHIBIT
Booth #956
at the
1958 DESIGN ENGINEERING SHOW
International Amphitheatre
Chicago, Ill.
APRIL 14-15-16-17

MARVEL ENGINEERING COMPANY
7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as follows—
☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
☐ Catalog #301—For Water MY-4
Name .....
Company .....
Address .....
City ..... State .....

Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

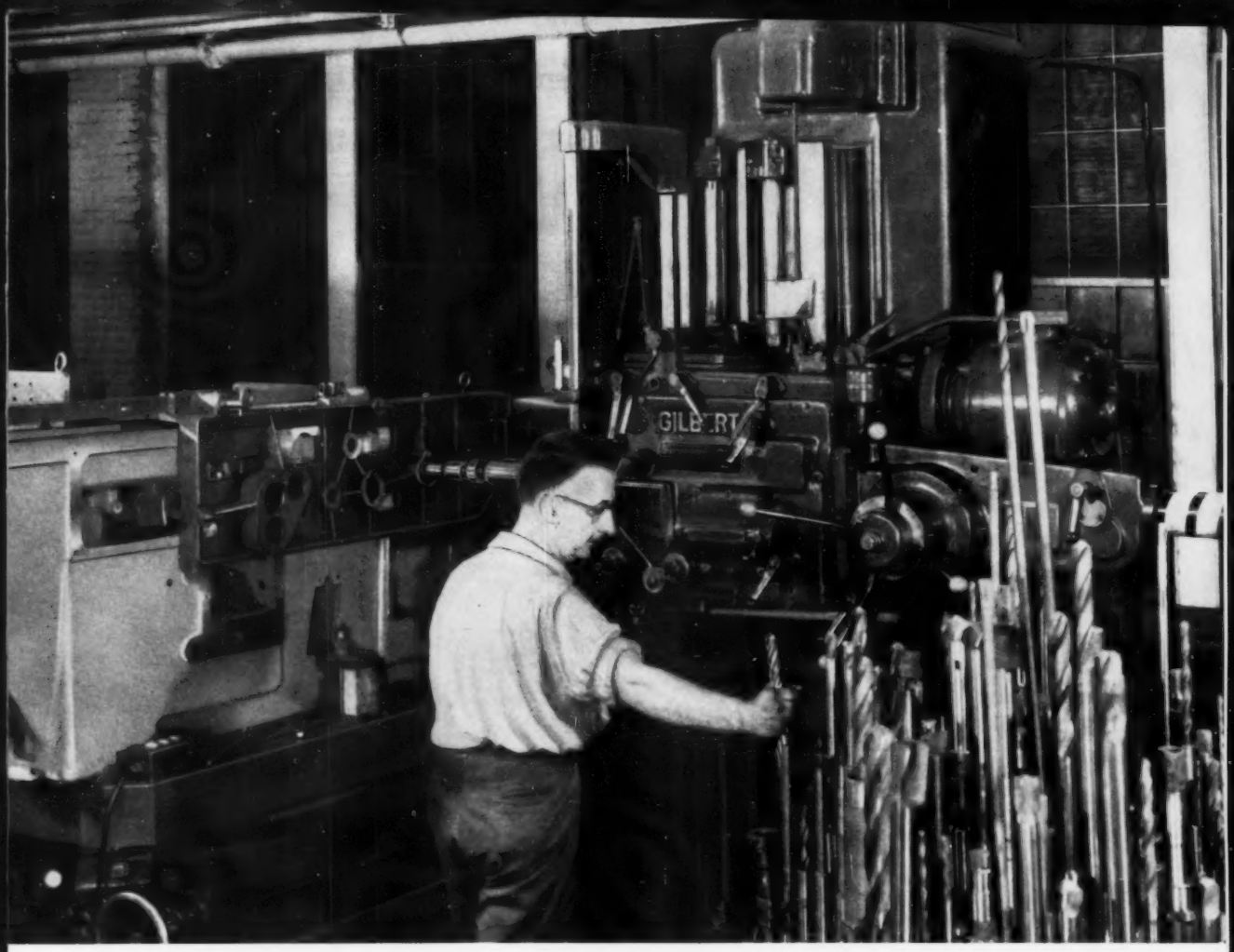
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.



courtesy Brown & Sharpe Mfg. Co.

Brown & Sharpe cuts time 75% with Gilbert boring mill

"The handling time on this job has been reduced by 75% and the machining time has been reduced by 40%," says T. R. Buckles, Equipment Engineer for Brown & Sharpe Mfg. Co.

These profitable savings were earned by fitting a Cincinnati Gilbert boring mill with a Gilbert revolving table, adjustable on runway, and traveling tool holder designed by Brown & Sharpe.

There are about 180 holes in the workpiece. The boring mill performs drilling, reaming, tapping, or boring operations as well as some milling cuts. The job was formerly done on a radial drill, portable drill, and floor type miller.

This is another typical example of the time saved (and profits earned) by Cincinnati Gilbert horizontal boring mills. Our man will be glad to show you more examples.

The Cincinnati Gilbert Machine Tool Co.
3346 Beekman Street, Cincinnati 23, Ohio

those who buy Gilbert buy **GILBERT** *again*

Now...

THE WORLD'S FINEST 10 x 15"
PERMANENT MAGNETIC CHUCK*

The new 10" x 15" O. S. Walker chuck, with super-strong ceramic magnets, has licked every problem formerly associated with this size. You get maximum holding power, without expensive wiring and controls, yet you get *complete demagnetization* in the "off" position. The "on-off" lever is extremely easy to actuate. The 10" x 15" weighs only 69 lbs. and is just 2⅝" high, thus minimizing machine table inertia, while leaving maximum machine capacity. The face of the chuck is *all* steel (no soft insulating material) to assure flatness, parallelism and dimensional stability. Fine pole divisions, with ¼" bar poles, hold even thin or narrow work tightly and uniformly over the entire face. Other permanent chucks with ceramic magnets are available in sizes 6" x 10", 6" x 12", 6" x 18" and 8" x 24" — the most complete line anywhere.

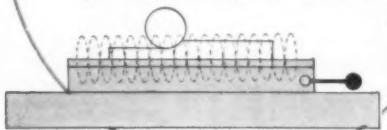
*Patents Pending

At the Show, Booth 1947

'58

Perfect for milling, too!

Walker permanent chucks have exclusive construction with magnets polarized *horizontally*. Cutter is constantly *demagnetized* as it progresses, with *no fouling* of cutter, work and chips!



Write for new Catalog 58 — it gives complete details on the Walker line of permanent, electro and vacuum chucks.

O. S. WALKER COMPANY, INC.
WORCESTER 6, MASSACHUSETTS, U.S.A.
The Original Designers and Builders of Magnetic Chucks

CHUCKS, Full Floating
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

CHUCKS, Independent
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Inc., Worcester, Mass.

CHUCKS, Power Operated
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Jacobs Mfg. Co., West Hartford 10, Conn.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Universal Engineering Co., Frankenmuth 2, Mich.

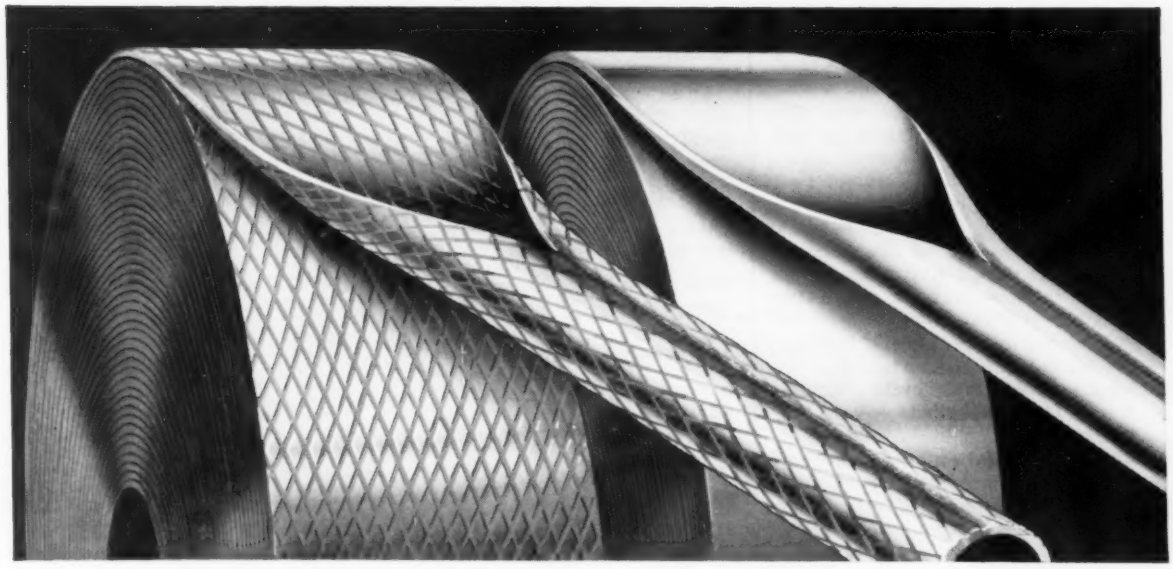
CHUCKS, Ring Wheel
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

(Continued on page 258)

Now... Aluminum Tubing... plain or patterned...Welded

with TOCCO* *High-Frequency Heating*



Quaker State Metals Company, leading fabricator of aluminum building products, recently installed a 25 kw, 450,000 cycle TOCCOtron vacuum tube oscillator for continuous welding of aluminum tubing. Both plain and patterned strip, anodized or untreated according to end-use requirements, is continuously welded. Diameters vary from ½" to 1" O. D. and wall thicknesses from .024 to .064".

The weld is absolutely uniform throughout the entire length, assuring a dependable, strong bond. The whole operation is so smooth and quiet, you hardly know it's running.

Aside from the perfect weld, for the ultimate in product quality, TOCCO Induction Welding, being a completely automatic process, saves time and money over many conventional joining methods.

Remember, whether *your* products are of ferrous or non-ferrous metals, TOCCO can almost certainly save *you* time and money in heat-treating, brazing, welding, or hot forming operations.

***Mail Coupon Today*—NEW FREE Bulletin**

The Ohio Crankshaft Co. • Dept. M-4 Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating".

Name_____

Position_____

Company_____

Address_____

City_____ **Zone**____ **State**_____

For more information fill in page number on Inquiry Card, on page 195

Design Analysis On Fasteners and Small Parts

Shows Cold Heading Usually Cuts Costs

This may very well be the age of "Design Analysis". And, one of the most promising fields for such a cost saving study is fasteners and small parts. Actually one of the most important cost cutting developments in recent years is the increasing use of cold headed parts and fasteners in place of more expensive and structurally weaker screw machine products.

The more expensive bar stock used in the screw machine method results in considerable waste, whereas the waste is almost negligible in cold heading.

Another important consideration is the greater strength structure of parts made by the cold heading method. The blow of the heading tool causes the grain structure of the metal to flow in lines of greater strength.

The possibilities of cold heading are almost unlimited when used in conjunction with secondary operations. The tremendous savings in operation and material costs make it a must consideration when designing small parts either as fasteners or as integral units for manufactured parts. It has been a long time policy of John Hassall, Inc. to support their cold heading equipment with the latest methods of secondary manufacture. Machines for roll threading, slotting, drilling, tapping and many other operations are available for your profit.

Given complete specifications, including a drawing and an idea of the application, we can quickly tell you whether or not it will be advantageous to have your fastener or part JOB-DESIGNED by HASSALL. The remaining important aspect of our service to you is the ability to get into production quickly and make prompt shipment.

Write today for your copy of our new Catalog No. 106.

John Hassall, Inc.

P. O. Box 2264

Westbury, Long Island, New York

Manufacturers Since 1850

See us at the Design Engineering Show

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logan port Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Fawick Corp., Cleveland, Ohio.
Minster Mch. Co., Minster, Ohio.
Rockford Clutch Div., Rockford, Ill.

COLD HEADING
Hassall, John, Inc., Westbury, L. I., N. Y.

COLLETS—See Chucks, Collet

COLLOIDAL GRAPHITE
Acheson Colloids Co., 2150 Washington Ave. Port Huron, Mich.

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., 54 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opta-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 1, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Bliss, E. C., Co., 1375 Raff Rd., S. D., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
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CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

COUNTERS
Starrett, The L. S., Co., Athol, Mass.

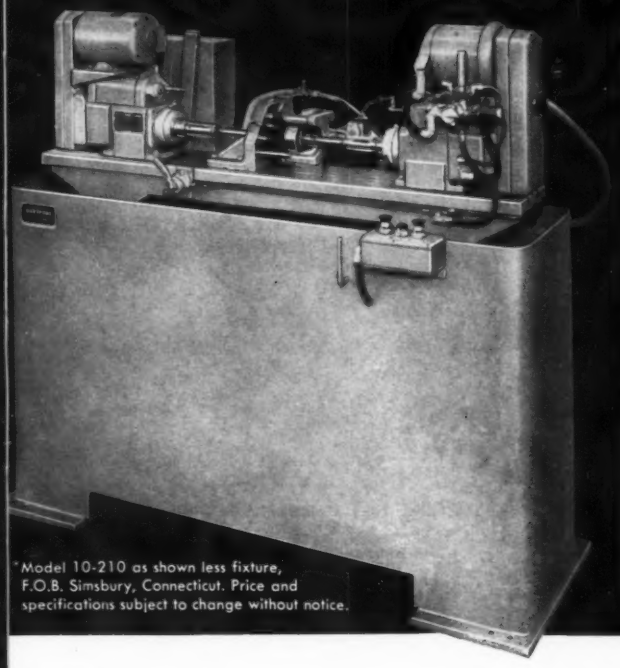
COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

For more information fill in page number on Inquiry Card, on page 195

new

HARTFORD DOUBLE END MACHINE

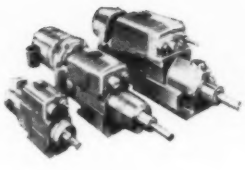
$3,565* Complete



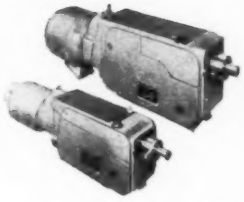
*Model 10-210 as shown less fixture, F.O.B. Simsbury, Connecticut. Price and specifications subject to change without notice.

- Opposed operations simultaneously
- Quick change of stroke, feed rate, spindle speed and unit position
- Handles parts up to 28" long
- Available with manual or automatic interlocked cycle
- Coolant tank, coolant pump, chip pan and coolant troughs integral with base
- Drill capacity to 5/16" in mild steel with 19-150 Unit
- Tapping capacity 3/8" with a maximum stroke of 1½"
- Use with small index table, manual or air clamp fixtures, hopper load devices or vibration feeders
- Adaptable to multiple spindle head applications
- Performs two operations per hole with index table
- Inexpensive, fast, flexible centering operations
- Available as basic machine — completely tooled or as separate components

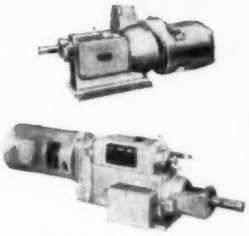
Rectangular Bases — 8" x 60" finished mounting pad accommodates a variety of drilling, boring or tapping units. Coolant tank with pump mounting flange, drain port, chip pan and large coolant troughs included. Adaptable to small index tables, air clamps or other part locators.



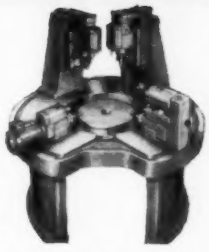
Automatic Drilling and Tapping Units — The Hartford Model 19-150 Quill Type Drill Unit is ideally suited as a working unit on the Double End Machine for production drilling, tapping, reaming, spot-facing, centering, milling, chamfering and countersinking. Other Hartford Units can be readily adapted also.



Automatic Cam Feed Drilling Units—Two models of these mechanical feed units are available. Designed for use with multiple head as well as single spindle applications, these electric clutch units are compact, dependable and fast cycling. They provide positive accuracy on long run jobs.



Automatic Lead Screw Tapping Units—No. 22 unit, above, features lead change through gearing from master lead screw. No. 19-175 unit, below, features variable quick advance stroke before starting lead screw spindle.



Other Hartford standard basic components including circular bases, straight post columns, tunnel columns and unit adapters can be combined with standard Hartford drilling and tapping units for assembly into production machines such as the 65" horizontal indexing machine shown above.

HARTFORD *Special*

Hartford also makes automatic Thread Rolling Machines, Special Machinery and the world famous Super-Spacer.

Machine Tool Division
THE HARTFORD SPECIAL MACHINERY CO.
2904 Homestead Ave., Hartford 12, Conn.

Send me complete information on Model 10-210 Machine and other machine components.

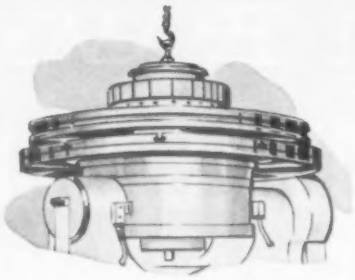
Name _____ Title _____

Company _____

Street _____

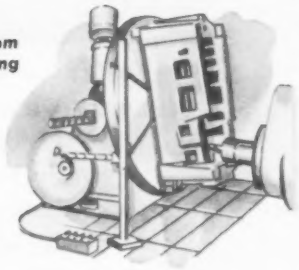
City _____ Zone ____ State _____

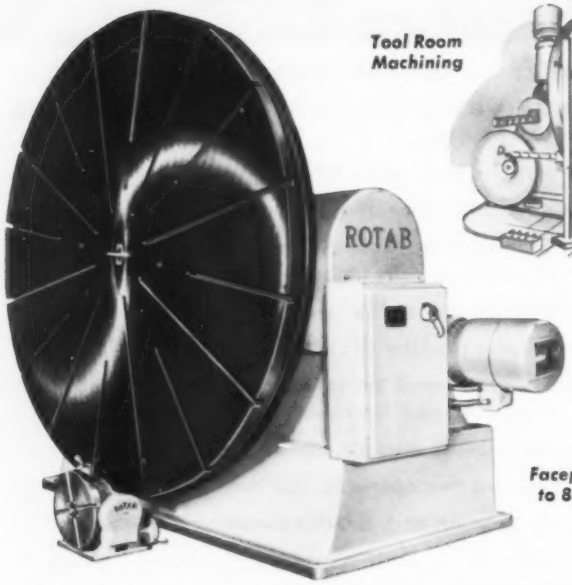
Inspection and Quality Control



Experimental and Tool Room Layout

Tool Room Machining





Faceplates from 12" to 84" in diameter

APPLICATIONS UNLIMITED... ROTAB® UNIVERSAL TABLES

Applications for *ROTAB* precision tables are, in fact, limited only by user imagination. For *ROTAB* units are being successfully utilized for receiving, tool and gaging, stage and final inspections, and for analytical spot checks on parts in process. *ROTABs* are proving highly effective in quality control for statistical data procedure, quality, casting and pattern analyses. They're saving time, increasing accuracies in experimental and tool room layout, too. And they've even performed outstandingly as cost-cutting machining fixtures for high accuracy positioning of difficult and complex tool room operations.

How does *ROTAB* come by this versatility? By offering single set-up, 3-dimensional positioning with optically precise 5-second accuracy, motor-driven, pendant controlled movement, horizontal loading and many more advanced engineering features. *You* can use *ROTAB*, and we can show how.

Write today for your catalog!

MACHINE PRODUCTS *Corporation*

6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw Mich.
National Twist Drill & Tl. Co., Rochester,
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St. Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill Co., Rochester, Mich. Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS
Cincinnati Milling Products Div., Cincinnati, Ohio.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

For more information fill in page number on Inquiry Card, on page 195

From Midget to Monster

WILLIAMS WRENCHES *fit the job**

In scale comparative illustration — Actual openings: Midget 3/16", Monster 3 1/8".

ALLOY WRENCHES

A complete selection from 33 patterns, 400 sizes with openings from 3/16" to 3 1/8". Drop-forged from selected alloy steel and heat-treated for maximum service. Quality chrome plated finish.

CARBON WRENCHES

From a tiny 2 1/2" to a giant 52 inches long — there are 29 patterns, 542 sizes with openings from 3/16" to 7 5/8". Correctly designed, they are made from selected carbon steel drop-forged and heat-treated for extra strength. Finish is black enamel.

***Over 95% of your wrench requirements are stock items in THE BROADEST LINE OF ITS KIND.**

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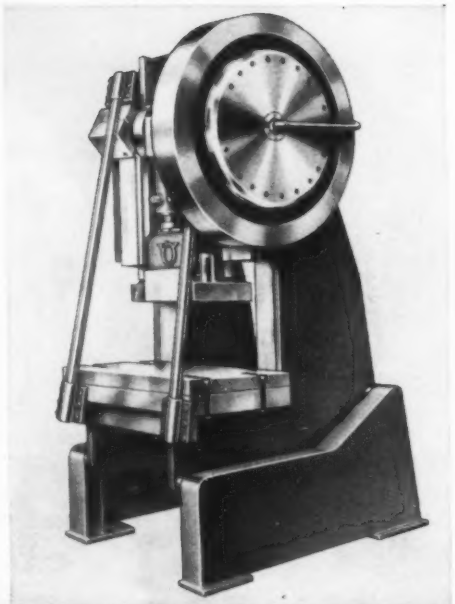
INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION

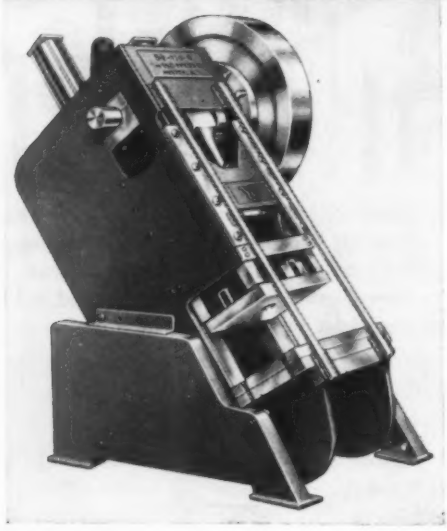
CALL YOUR LOCAL DISTRIBUTOR

J. H. WILLIAMS & CO.
409 VULCAN STREET
BUFFALO 7, NEW YORK

TWO NEW LONG SLIDE PRESSES by V&O

High speed 60-Ton T-Line Press, built to JIC Specifications, with 4" stroke operating at 150 SPM; low inertia air clutch with electrical controls; slide has detachable head to simplify changing from standard to flanged slide face; hand or air operated inclining mechanism.





Box-slide 110-Ton Inclinable (JIC Specifications) features exceptionally long ways (35") with new type power slide adjustment that eliminates movement between Pitman connection and slide; self-cooling combination clutch and brake with friction surfaces replaceable without removing flywheel.

EMHART MANUFACTURING COMPANY
THE V & O PRESS COMPANY DIVISION
HUDSON, NEW YORK

SEE BOTH UNITS AT SHOW—BOOTH 721

CYLINDERS, Air
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

For more information fill in page number on Inquiry Card, on page 195

STERLING TRAY COURTESY TIFFANY AND CO., NEW YORK

1958 ASTE TOOL SHOW • CONVENTION CENTER • PHILADELPHIA

MAY 1 THROUGH MAY 8

HIGH PRECISION MACHINE TOOLS and MEASURING EQUIPMENT

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Utz, Georg, Zurich, Switzerland
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

DISINTEGRATORS
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Electro-Spark Co., Inc., 23 E. 26th St., New York 10, N. Y.
Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS
Allen Mfg. Co., 133 Sheldon St., Hardford 2, Conn.
DoAll Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAWING COMPOUNDS
Oakite Products, Inc., 26 Rector St., New York 6
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DRIFT KEYS
DoAll Co., Des Plaines, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.

(*Continued on page 266*)

NEW
GREAVES
TOOLMAKERS
OVERARM

Here's the way to add new "firepower" to toolroom milling operations! Install in your toolroom a GREAVES MILL equipped with this new Toolmakers Overarm.

You'll discover new versatility for milling intricate jig and fixture work, for keywaying, slotting and angular milling. Two graduated swivels permit mounting the spindle head in almost any angle for milling, drilling, spot facing and related operations.

Powered by an independent 2 HP motor, the unit is driven through helical gears. Eight speeds may be selected with convenient controls operating speed change clutches. A hand-fed quill attachment provides 4" tool travel to the spindle. Arbor support fits overarm, permits arbor type milling without changing overarm.

Write for Complete Specifications and Prices

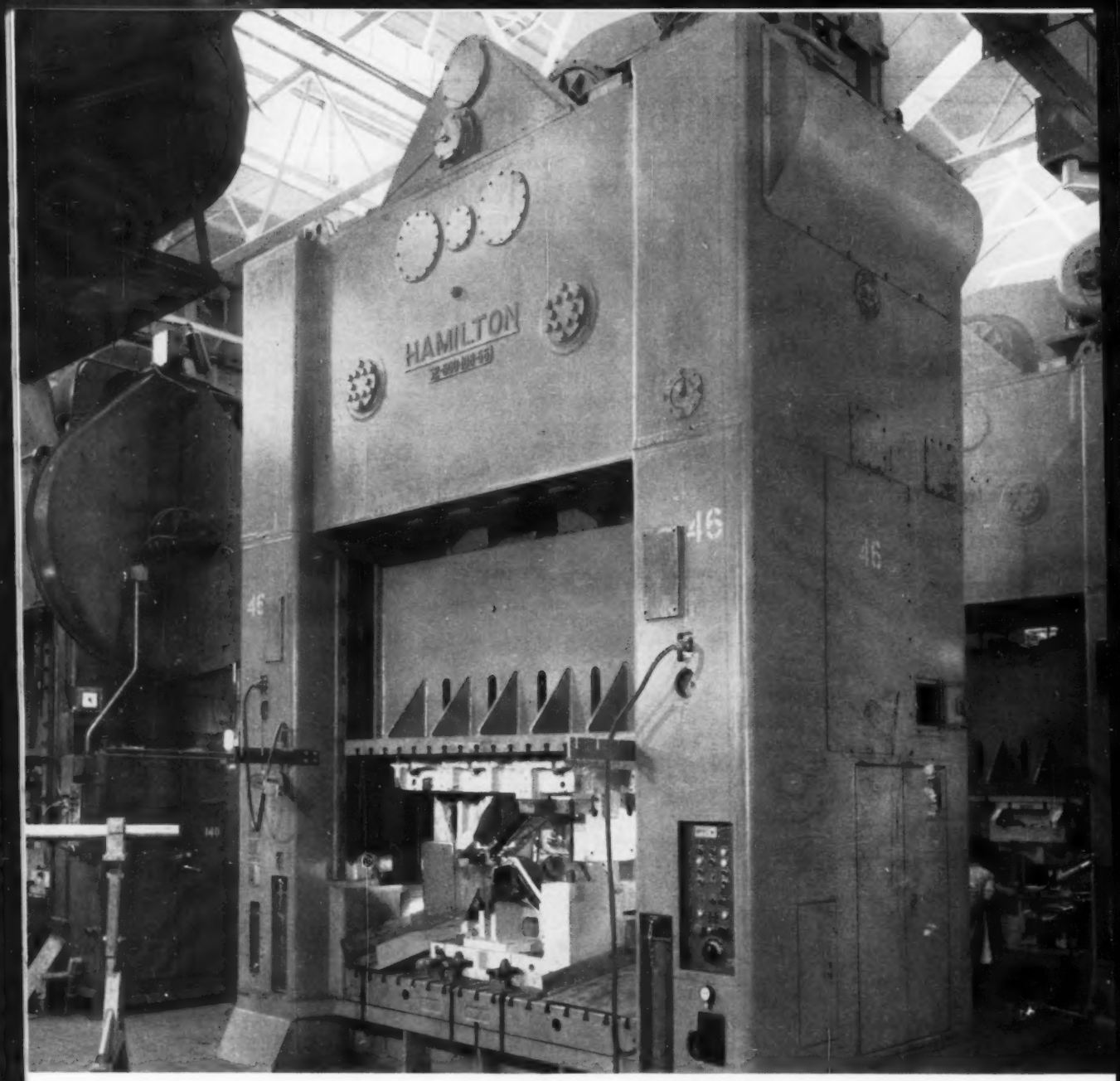
- Swivels permit any angular setting of spindle head.
- 2 HP independent motor drive.
- 8 speeds from 175 to 1750 RPM.
- Quill has 4" hand feed.
- Spindle equipped with No. 50 N. S. taper; reduced to No. 2 Morse taper when Quill Attachment is used.
- Gears run in oil bath.
- Full vision oil level gauge.

RACK FEED. The overarm is equipped with rack feed for positioning over work.

GREAVES MACHINE TOOL DIVISION
J. A. FAY & EGAN COMPANY
2500 Eastern Avenue, Cincinnati 2, Ohio

Manufacturers of
GREAVES MILLS
"the MOST Mill for the LEAST Money!"

For more information fill in page number on Inquiry Card, on page 195



This versatile 600-ton Hamilton Eccentric Gear Press is currently turning out a wide variety of parts in a major automobile plant in Detroit.

Why an eccentric gear press?

Hamilton Eccentric Gear Presses are ideally suited for heavy duty operations—particularly deep draws and other stamping operations where the tonnage is encountered well up on the stroke.

The eccentric and gear are integral and rotate on a short eccentric pin, as a result of which torsional and bending loads are negligible.

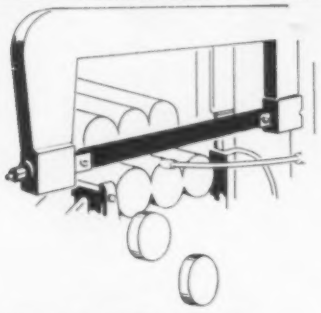
The many added features of Hamilton Eccentric Gear Presses guarantee greater production, improved stamping quality, and lower maintenance costs.

Write to Dept. 3D for Bulletin #13301, describing these machines

Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools



Capewell High Speed Power Hack Saw Blades can take higher speeds and feeds for higher production and profit

3 TYPES FOR EVERY PURPOSE

TECHNITE®

HIGH SPEED®

SAFETECH®

See Your Capewell Distributor

CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Snow Manufacturing Co., Bellwood, Illinois

DRILL SLEEVES AND EXTENSION HOLDERS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.

DRILLING AND BORING UNITS, Self-contained

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Automatic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Secrest Machine Co., Washington, D. C.
Snow Manufacturing Co., Bellwood, Ill.
Townsend H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.

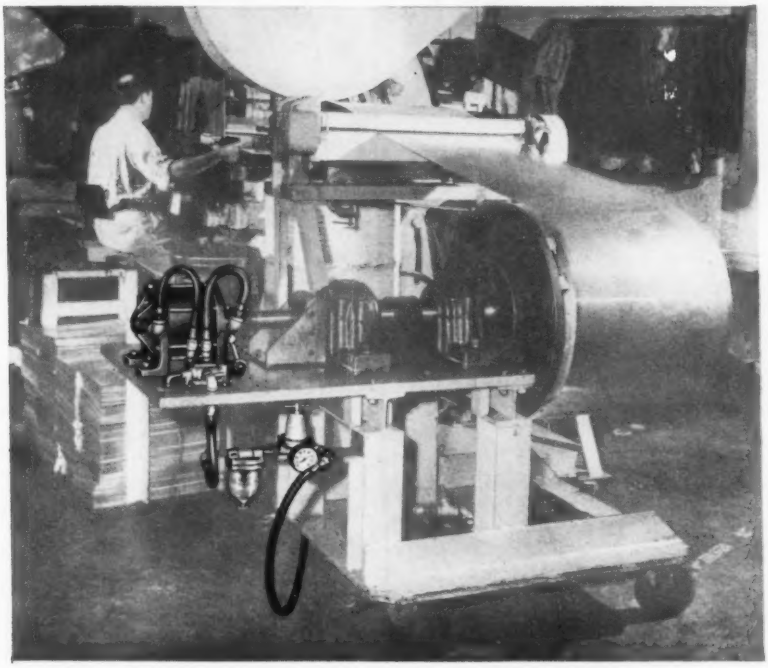
DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

YOU CAN TAILOR AIR CONTROL UNITS FOR ANY JOB WITH STANDARD SCHRADER PRODUCTS



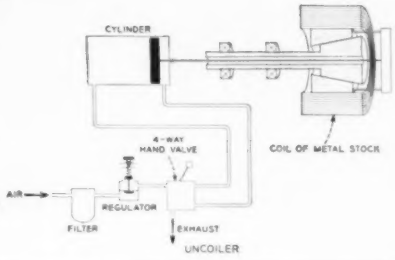
Every day more designers, more engineers are solving problems with air. They're planning air systems to hold, clamp, move, trip, feed, eject . . . from tiny parts to 3000-pound coils.

Air is versatile, economical, safe, fast. And when you select your components from Schrader, you choose from the most complete line of air products. Whenever you mechanize manual operations, or automate mechanized ones, investigate air. Schrader engineers are prepared to help you like we did here.

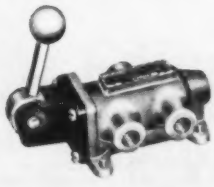
HERE'S AN INTERESTING SHOP PROBLEM SOLVED BY SCHRADER: How to strip steel from 3000-pound coils:

Radial jaws actuated by a Schrader air cylinder hold the coil firmly on an expanding mandrel. A 4-way valve and a pressure regulator govern the air power. Wherever uncoiler is needed it is plugged into an air line with quick-acting couplers. Opening the 4-way valve actuates the cylinder and the operator works freely at this machine. Just imagine the time and trouble, this one idea saves this company!

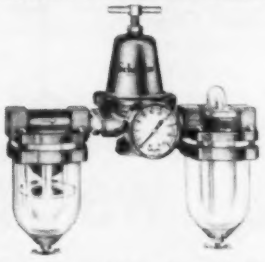
Here's the hook-up



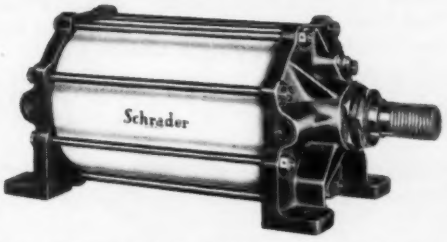
HERE ARE SOME OF THE SCHRADER PRODUCTS SELECTED FROM THE HUNDREDS OF SIZES AND TYPES:



Four-Way Hand Valve operates through a simple hand lever. Can also be operated automatically or with pedal.



Lub-air-ator: special 3-part unit that lubricates, regulates, filters air line. Easily adjusts pressure.



Double Acting Cylinder: is used here for its powerful two-direction stroke. For one way powered stroke, use single acting cylinder with integral spring return stroke.

Schrader® a division of SCOVILL

We can help you put Schrader Products to work just as profitably and our Distributors are conveniently located for fast delivery.

Information is available by writing directly to us—

A. SCHRADER'S SON, *division of Scovill Mfg. Co., Inc.*
454 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

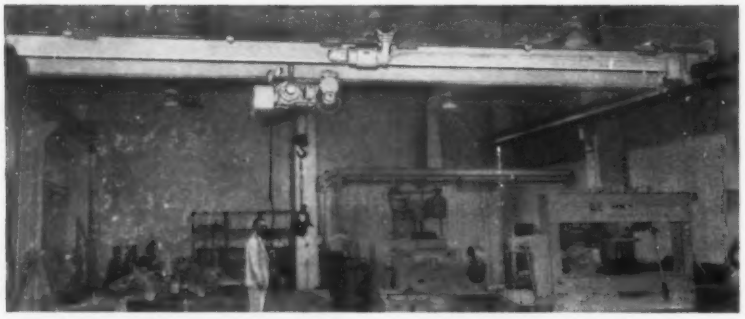
For more information fill in page number on Inquiry Card, on page 195

SHEPARD NILES

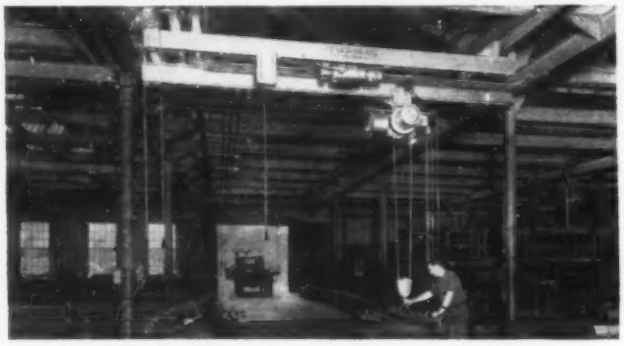
SINGLE BEAM CRANES

WHICH CRANE

. . . Over-running or Under-running?



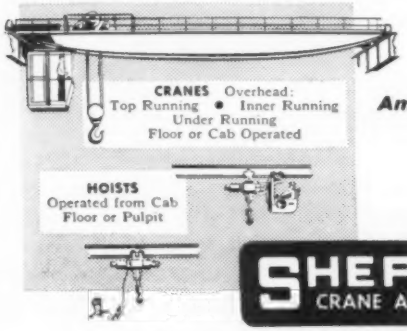
OVER-RUNNING where double beam cranes are not practical or for auxiliary service.



UNDER-RUNNING . . . for limited clearances . . . operating on runways hung from roof trusses!

Cut costly ground level handling. Move loads smoothly and safely overhead with Shepard Niles single beam cranes. Operate from floor or remote location. Push type or motor driven trolley type hoists, including close clearance units.

Send for Single Beam Crane bulletins today . . . or ask that a Shepard Niles representative call — there's NO OBLIGATION.



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Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
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Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
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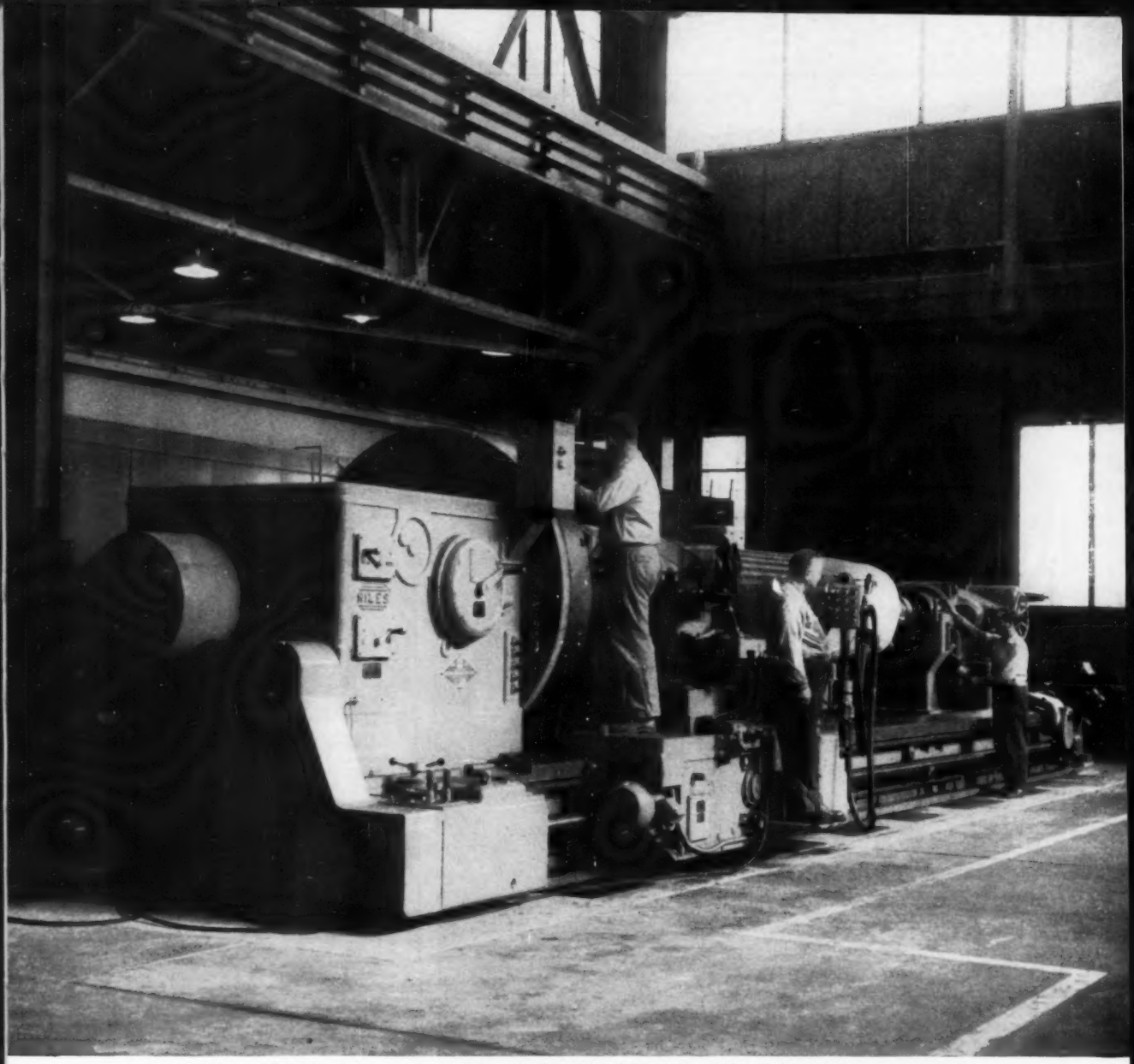

This new 72 in. x 38 ft. Niles lathe recently installed at the Consolidated Edison Co. of New York repair shop at Astoria can handle all the rotary fields and three-fourths of the high-speed turbine spindles in the company's network of generating plants.

Con Edison to save thousands yearly with new Niles Lathe

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Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core
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DoAll Co., Des Plaines, Ill.
Ex-Cell-OCorp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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DoAll Co., Des Plaines, Ill.
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Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
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Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
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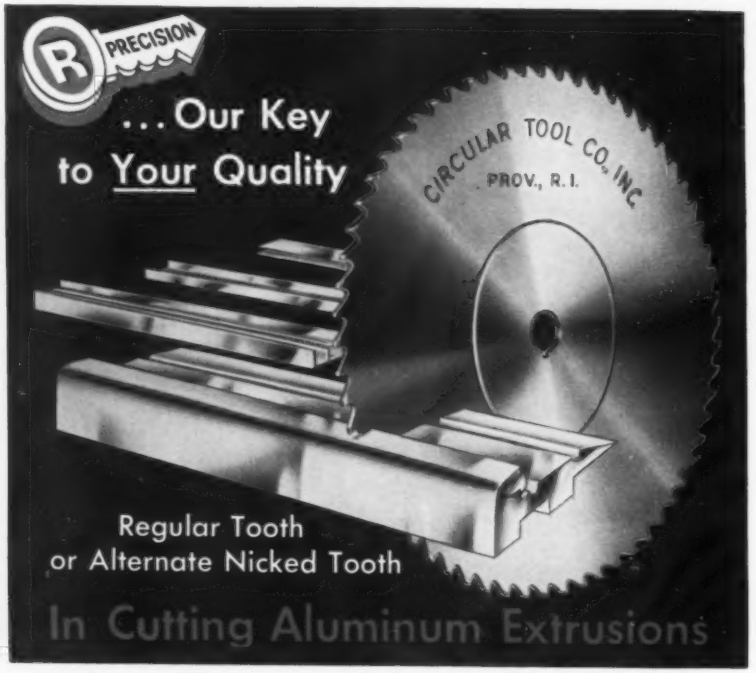

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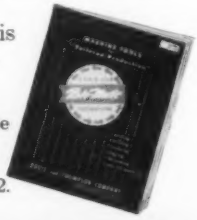

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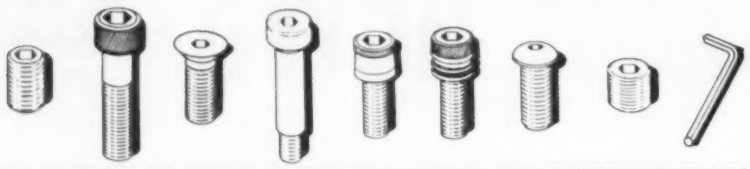

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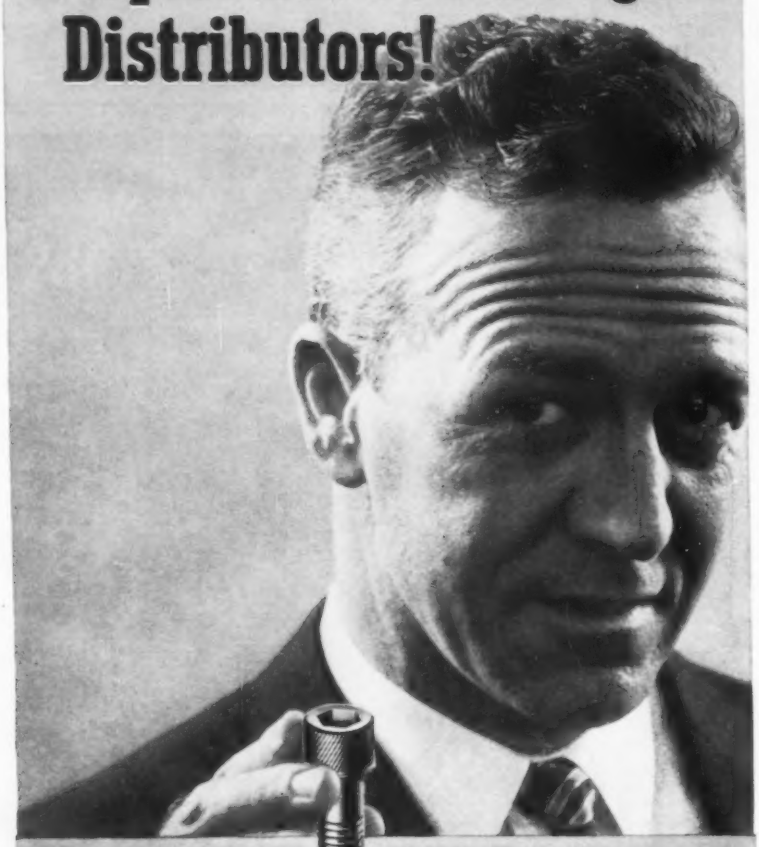

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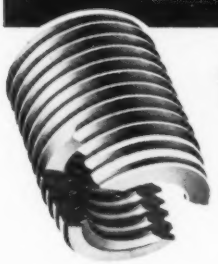

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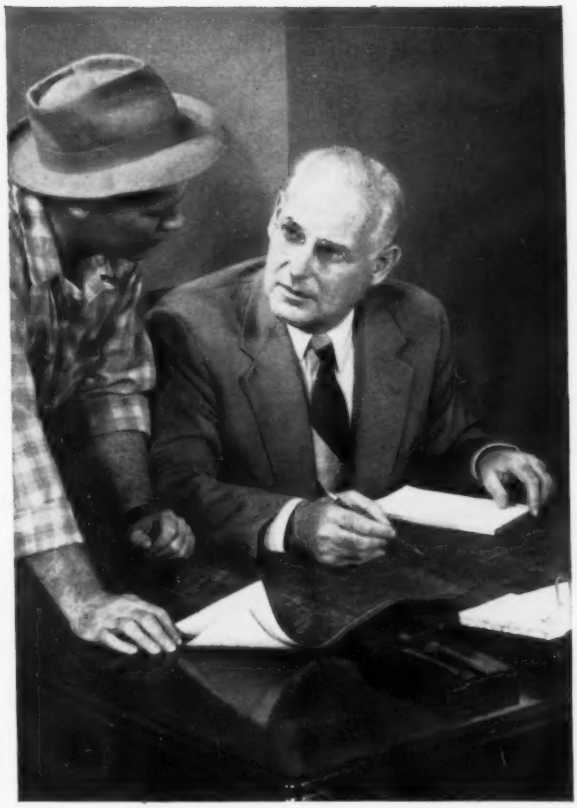

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Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Grinding
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness
Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness
DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth
Brown & Sharpe Mfg. Co., Providence, R. I.
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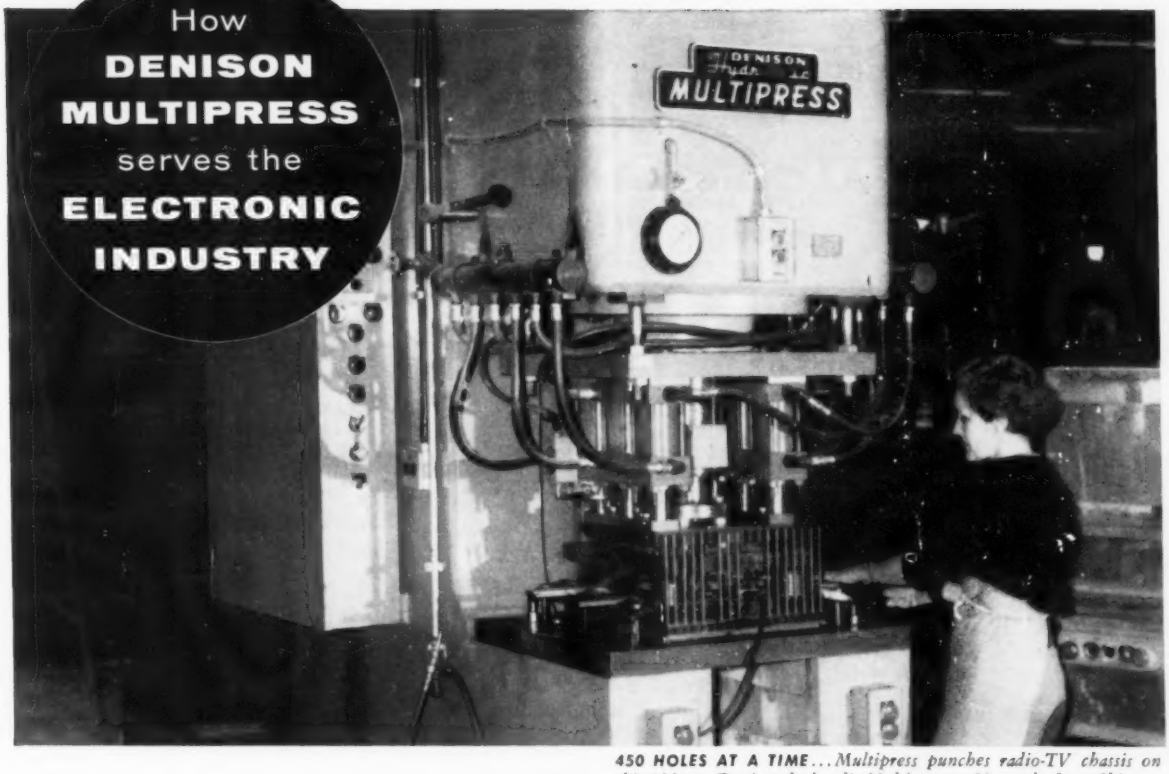

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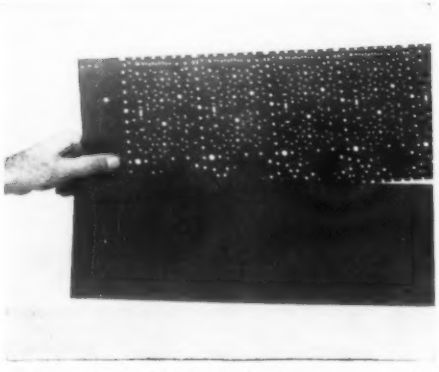

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Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
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(Continued on page 280)

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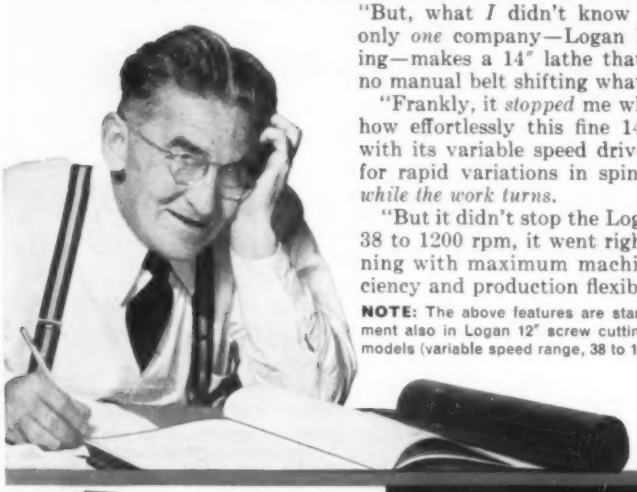

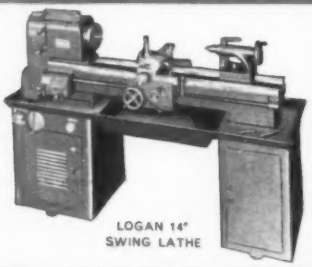

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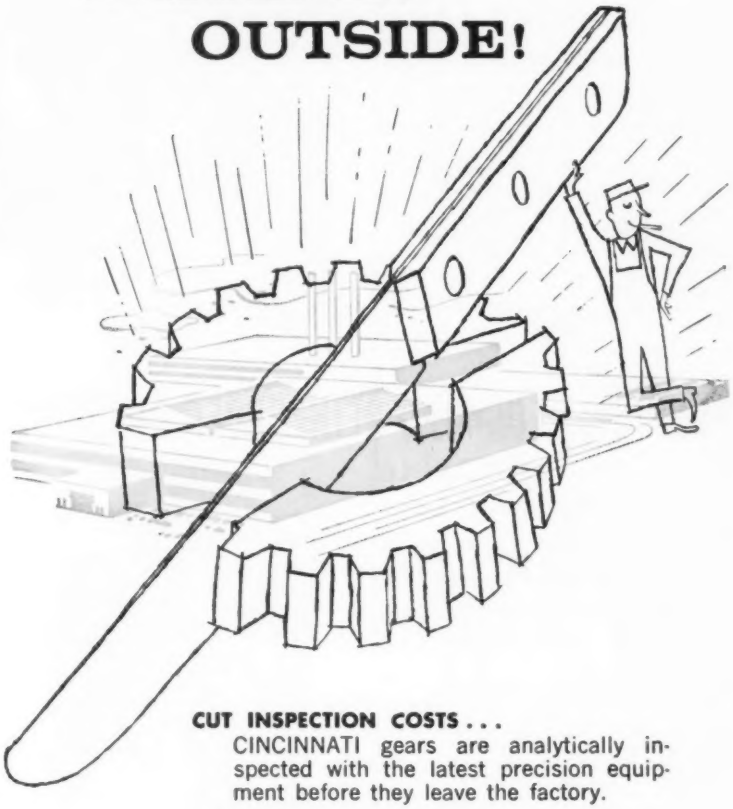

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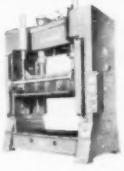
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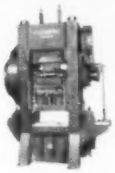
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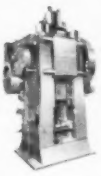
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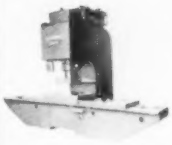
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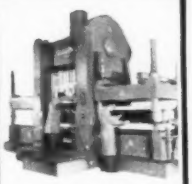
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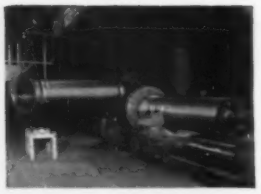

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Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio
Van Norman Mch. Co., Springfield, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32 Mich.
Jones & Lamson Mch., Springfield, Vt.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

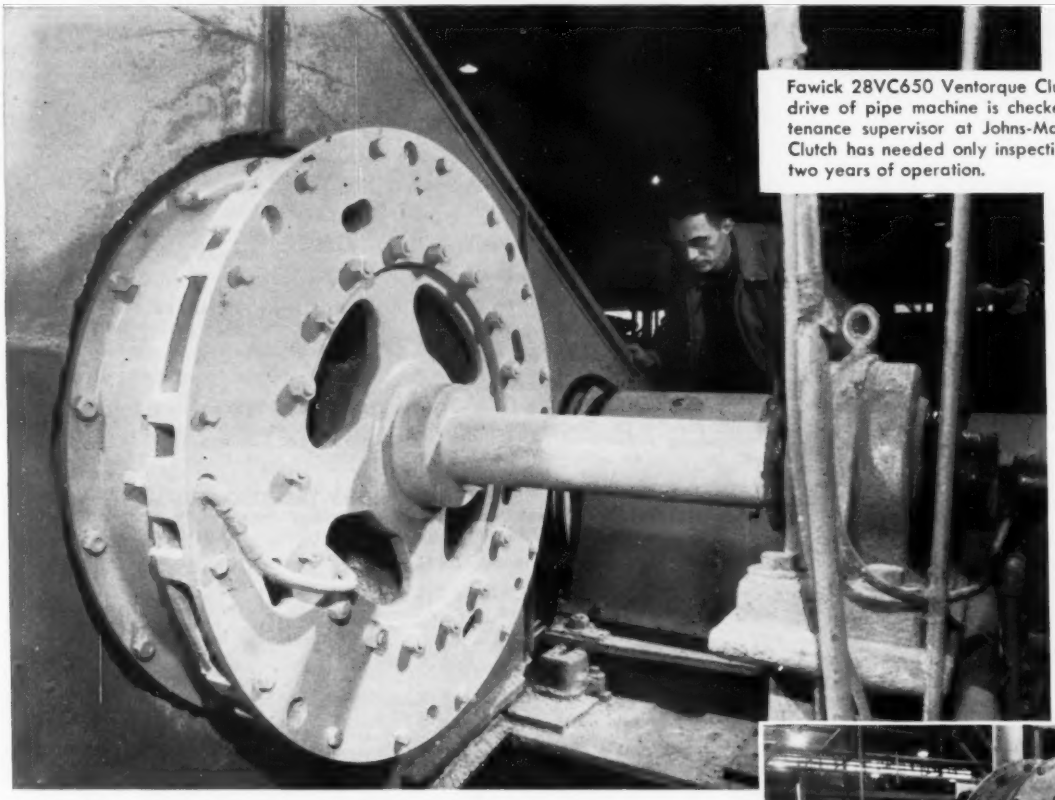
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8 Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids, 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Surface Rotary

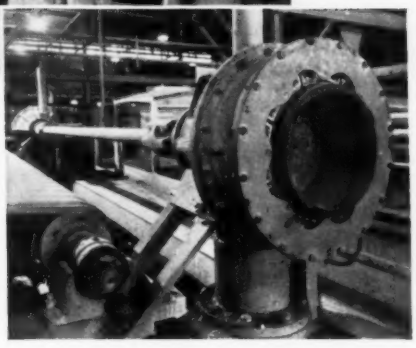
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Gardner Machine Co., Beloit, Wis.



Fawick 28VC650 Ventorque Clutch on main drive of pipe machine is checked by maintenance supervisor at Johns-Manville plant. Clutch has needed only inspection during its two years of operation.

Like Johns-Manville Transite Pipe Plant, you can . . .

use Fawick Clutches to improve machine performance and reduce maintenance costs



Fawick 11.5VC500 Ventorque Clutch locks press roll on pipe machine to desired pressure for special Transite pipe production. Precise operation despite heavy dust load helps machine keep pace with production schedules.

Machines producing Transite pipe give clutches a rough going-over: sudden, high-impact starting loads . . . rapid build-up of abrasive cement and asbestos dust . . . accurate cycling requirements . . . 'round-the-clock operation six days a week. Tougher conditions would be hard to imagine. Yet, FAWICK Airflex Clutches at Johns-Manville deliver dependable performance and meet increasing production demands with no maintenance or downtime. Some have been installed for over six years with only routine inspection.

Reasons for this record lie in the design of FAWICK Clutches:

- operation of FAWICK Drum Type Clutch unaffected by foreign material.
- durable drum-type construction takes years of punishment.
- rubber air tube cushions operating shocks.
- self-adjusting friction shoes automatically compensate for wear.
- mechanical linkages have been eliminated to provide smoother, more accurate operation.

These are the proof—for long clutch life and trouble-free service, you can't beat a FAWICK Clutch. For more information, contact your nearest Fawick representative or the home office.

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FAWICK CORPORATION
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National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.

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Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Mackin Co., Jackson, Michigan
Metal Carbides Corp., Youngstown, Ohio
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Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.

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Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.
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Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

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Holcraft & Co., 6545 Epworth Blvd., Detroit 10, Mich.

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National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
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Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
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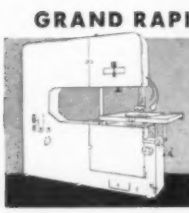

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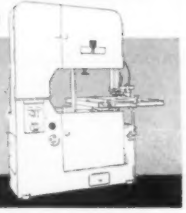

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Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Breach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
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Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
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Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Match & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich
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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch., 3640 Main St., Springfield 7, Mass.
Vinco Corp., 9111 Schaefer Highway, Detroit, Mich.

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DoAll Co., Des Plaines, Ill.
Starrett, L. S. Co., Athol, Mass.

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Brown & Sharpe Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th-N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S. Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

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Federal Products Corp., P. O. Box 1027, Providence, R. I.
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Starrett, The, L. S., Co., Athol, Mass.

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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
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Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
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(*Continued on page 288*)

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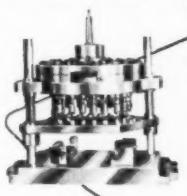

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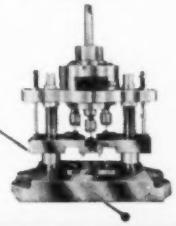

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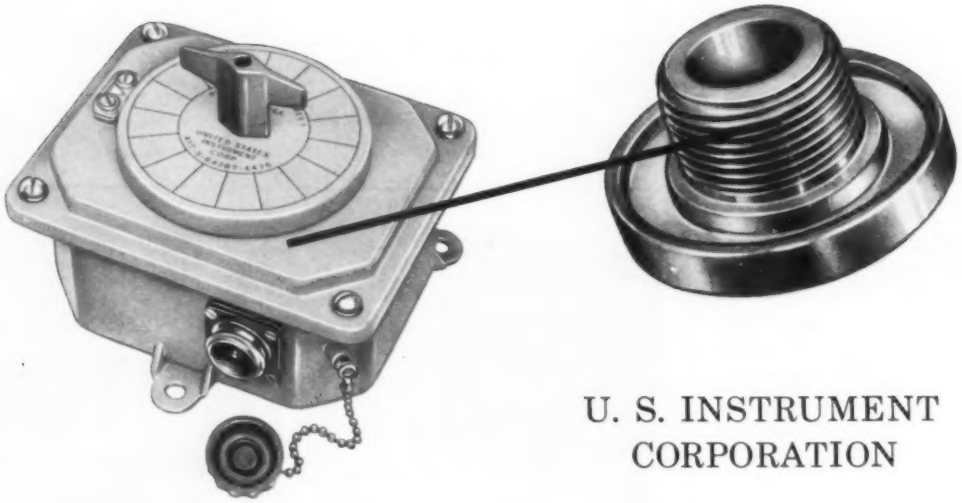

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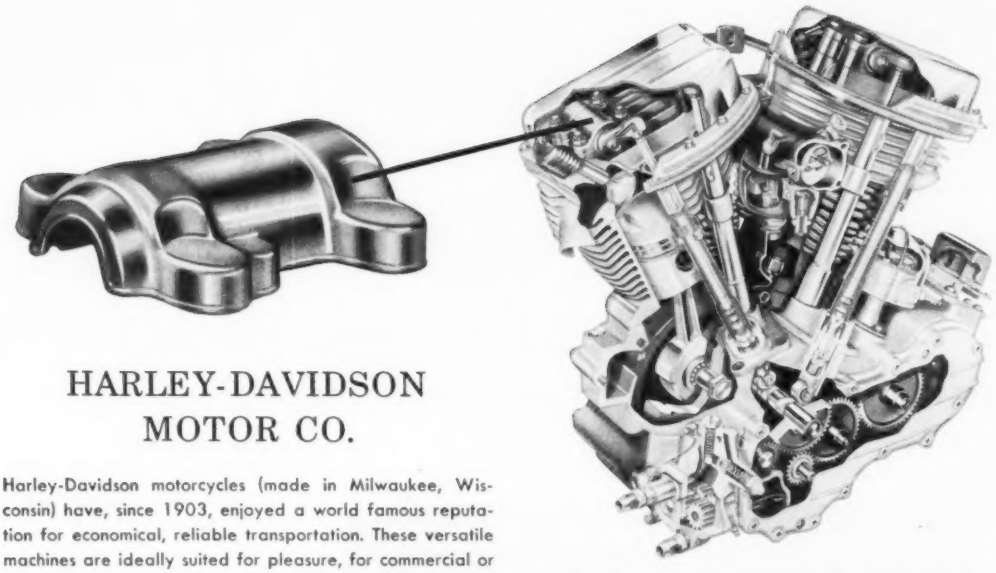
U. S. Instrument Corporation, Charlottesville, Va., selected abrasive-resistant Mueller bronze alloy bushings for their remarkable telephone selector switches after exhaustive tests of many materials. A vital communications link on today's U. S. Naval vessels, these sound-powered telephone circuits must meet rigid Navy performance-standards. Such phones, for example, must have selector switches which are capable of rotating for a minimum of 50,000 torturous cycles . . . 360° clockwise, followed by 360° counter-clockwise. In addition, the "O" ring must still form a water-tight seal AT THE END OF THE TEST! Of the many tested, a Mueller Brass Co. special manganese bronze alloy was the best one meeting these rigid specifications.

There were other important reasons why these bushings were chosen by U. S. Instrument Corporation for this application. Resistance to abrasive action against the rubber "O" ring was a prime one . . . then, too, the stem assembly suffered severe pounding through the action of the indexing mechanism which, prior to the use of the Mueller Brass Co. alloy, caused repeated seizure of the component parts. In this particular application, the part was fabricated on an automatic screw machine rather than produced as a forging. The versatility of Mueller Brass Co. alloys makes them readily adaptable to the most economical method of fabrication dependent upon the size, shape, and end-use requirements of the part.

In commenting on the success of this part, U. S. Instrument Corporation praised the alloy for its tensile strength (ordinary brasses could not withstand the 2000 ft. lb. impacts without deformation), for its machinability and corrosion-resistance.

MUELLER BRASS CO.



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Harley-Davidson motorcycles (made in Milwaukee, Wisconsin) have, since 1903, enjoyed a world famous reputation for economical, reliable transportation. These versatile machines are ideally suited for pleasure, for commercial or business use, as well as the grueling demands of law enforcement work. Harley-Davidsons boast a dependable engine . . . one which can roll up an astounding mileage record with little or no care. The painstaking selection of every engine component is one important reason for this reliability. The new twin-cylinder Harley-Davidson 74 OHV employs Mueller Brass Co. bronze alloy forgings in the form of rocker-arm bearing caps. Subjected to violent temperature changes, fast starts and stops and road shock, Mueller forgings are proving again and again that they have the ability necessary to withstand almost any punishment . . . and still provide unfailing service.

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- **Copper Base Alloys in Rod Form** Engineering Manual FM-3010 ☐

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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Do-All Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

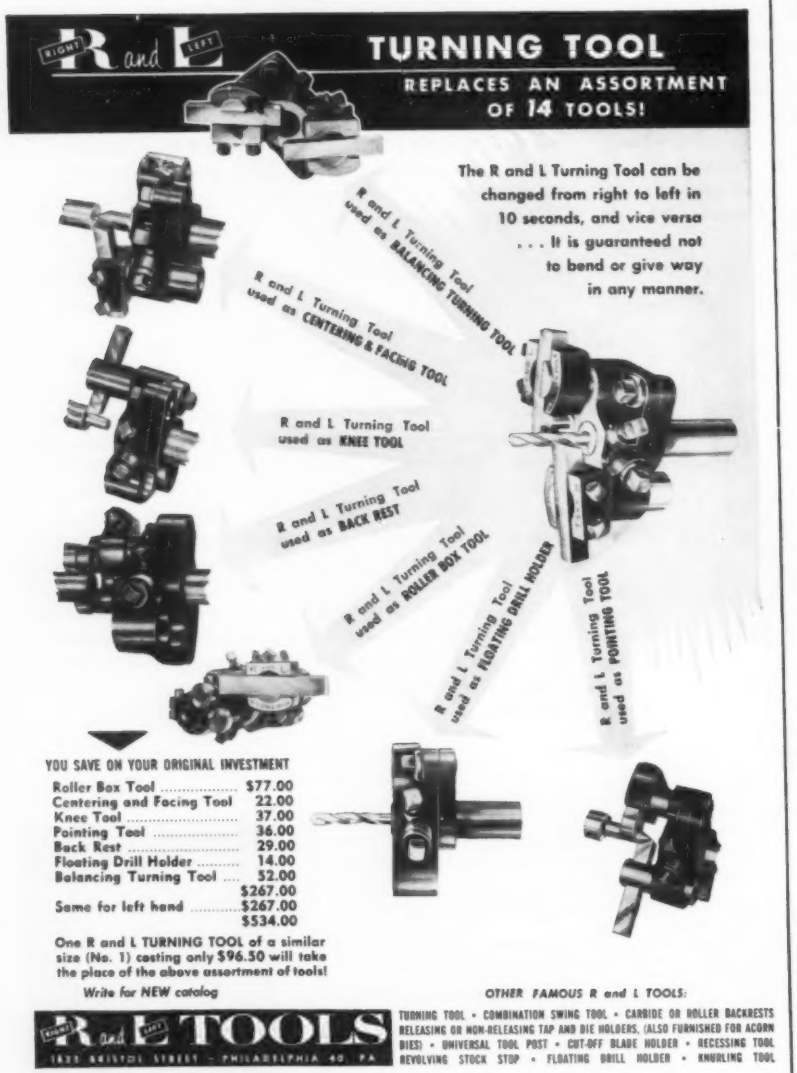
LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating — See Lathes, Duplicating

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 4, Ill.

LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Gap

Atlas Press Co., Kalamazoo, Mich.
Cincinnnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.

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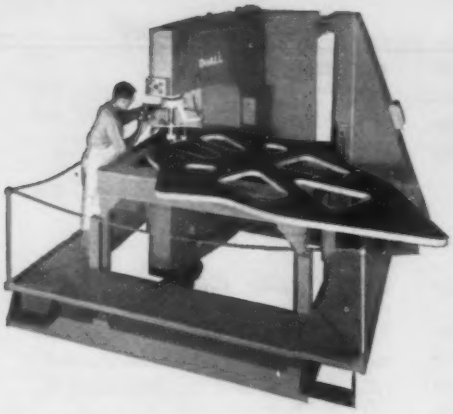

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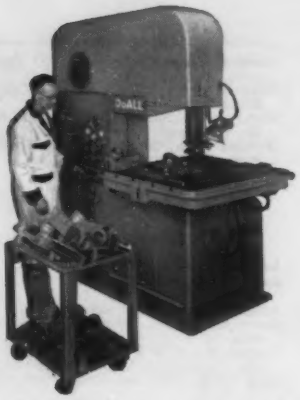

CONTOUR-MATICS for sawing, filing, grinding and polishing; cut machining time in half as compared to other methods. Super-fine finish eliminates secondary operations. Introduced with Demon HSS Blades, they give 10 times greater cutting rate and 30 times more tool life. Handle production machining and toolroom work with simplest fixtures: hydraulic power feed table, infinitely variable tool velocity, and coolant system. Available in four models, 16" to 60" throat.
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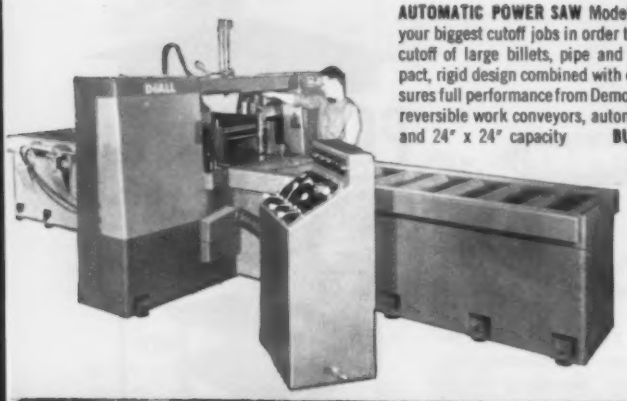

AUTOMATIC POWER SAW Model C-24 is built for your biggest cutoff jobs in order to provide low-cost cutoff of large billets, pipe and structurals. Compact, rigid design combined with extreme power assures full performance from Demon HSS Blades. Has reversible work conveyors, automatic chip removal and 24" x 24" capacity **BULLETIN No. 56-61**

POWER SAW Model C-58 sets world records for fast, automatic cutoff sawing—easily adapted with standard attachments to meet any specific production requirement. Designed expressly for Demon High Speed Steel Blades. Has infinitely variable speeds and 12" x 12" capacity. Also available with manual feed—Model C-57.
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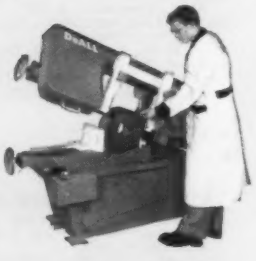
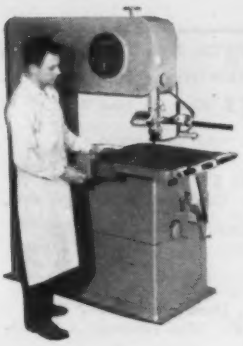


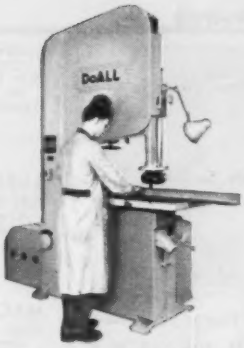
POWER SAW Model C-12 offers accuracy at low cost for the small shops or intermittent production. Ample power and rigidity assure maximum performance from Demon HSS Blades. It is unsurpassed for accurate machining of tough, expensive steels, pipe, structurals, etc. Four speeds, 12" x 12" capacity, and manual control.
BULLETIN No. 56-62.

What is your cutoff job? DoALL Power Saws will show you how they can be cut faster, cheaper and more accurately than by any other machine.



CONTOUR MACHINES for general- or special-purpose sawing, filing and polishing operations. Manually operated and economically priced, they have same rugged, rigid construction, modern design and precision performance as Contour-Matics. Standard features include heavy-duty tilting table, infinitely variable tool speed, and weight-controlled power feeds. Available in 16" to 60" throat and 8½" to 13½" work height capacity.

BULLETIN Nos. 55-30 and 54-702.



ZEPHYR Band Machines for friction sawing of ferrous metals at blade velocities up to 15,000 f.p.m. and high-speed sawing of nonferrous materials. Has rigid, integrated steel construction, power feed tables, automatic brakes and variable tool speeds. Available in four models, 16" to 60" throat capacities. **BULLETIN No. 52-303.**

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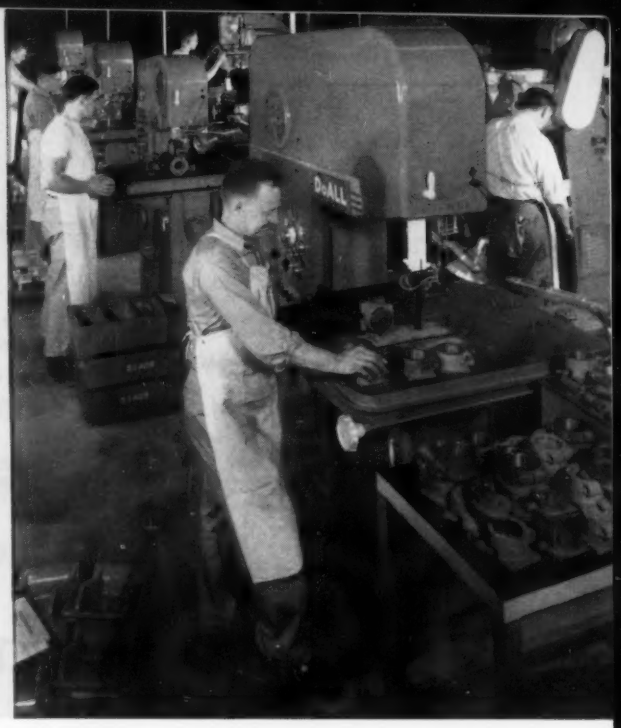

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Starrett, L. S., Co., Athol, Mass.

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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The, L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

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Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
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G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave. Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

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Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Nichols, W. H. Co., Waltham 54, Mass.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand

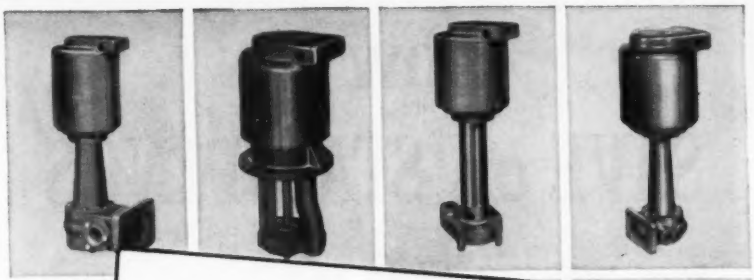
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Nichols, W. H. Co., Waltham 54, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Arrow Engineering Co., Inc., 120 E. Market St., Indianapolis, Ind.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Colonial-Romulus Div., Parkgrove Station, Detroit 5, Mich.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp., of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.



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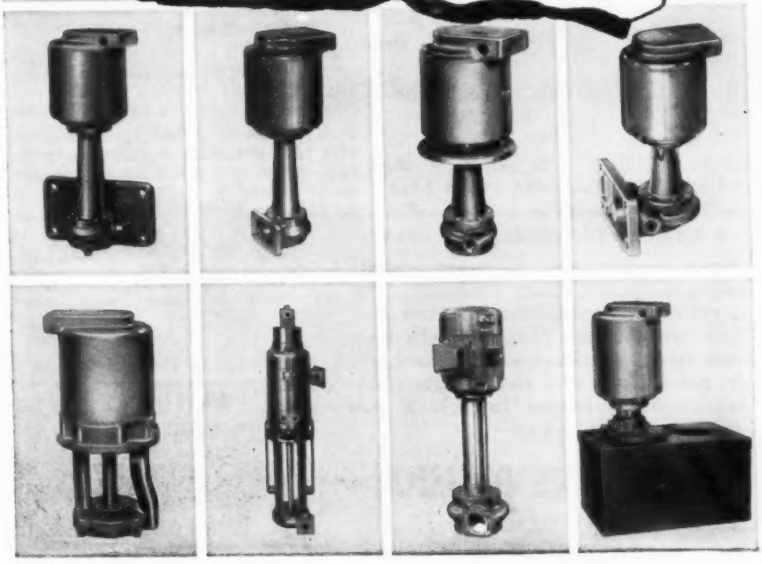


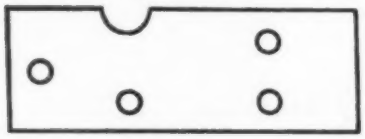
How to SAVE on STAMPINGS

If you buy stampings, it will pay you to read these important suggestions. They will help *us* to help *you*... (1) with faster deliveries... (2) with lower prices.

Your blueprint and the data on it are our bible! We must assume that all tolerances and limitations shown are strictly essential to the functioning of the finished part.

We want to—and we will—give you *exactly* what you require. But if there are unnecessary restrictions or requirements you'll be paying more than you need to. You don't like that. We don't either.

FOR EXAMPLE:



Here's a simple, hypothetical stamping. Tolerances for all the holes and the slot are specified "plus or minus .001"—so we assume such close tolerances are essential to the proper functioning of the piece.

In the light of these close tolerances, your part would cost you $X per M. In effect *you* set the price. We don't. But your parts, when you get them from *this* shop, will meet every one of those specs.

Now, from long experience, we know that in many cases like this some of the requirements *could* be relaxed.

Let's say, for example, that plus or minus .003 is actually adequate for 3 of the 4 holes and the slot. It's comparatively easy to hold to .001 on *one* hole if there's a latitude of plus or minus .003 on the other holes and the slot.

How would these modifications affect what you pay? Your cost would be a *fraction* of $X per M, probably a *small* fraction. That would make *you* happy, *and* us too.

OTHER WORTHWHILE POINTS:

Quantities. Order maximum. Higher quantities mean lower unit cost. Three runs of 2,000 can't cost the same as one run of 6,000.

Short Runs. If you want *short run* stampings, try to set your tolerances accordingly. It isn't practical to hold the same tolerances in Short Runs as in Production Runs.

De-burring. If you must have *all* burrs removed that's readily done. But if *smooth pieces* will do, don't specify "Remove all burrs." You'll save money.

Punched Holes. When specifying hole size try to specify a standard punch size. Saves you the cost of a custom made punch.

A WORD TO THE PURCHASING AGENT:

When requirements or specs appear more stringent than necessary, we question them with the customer. But this takes time. **Therefore—to help save time and money—we suggest you do not include any specification, tolerance or limitation for which you are not willing to pay.**

For more complete information, send for our free 12-page booklet, "Service in Stampings"

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Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Austin Industrial Corp., 76 MamaroneckAve., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Ferndale, Mich.
Gorton, Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Machine Co., Inc., 4240-5258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

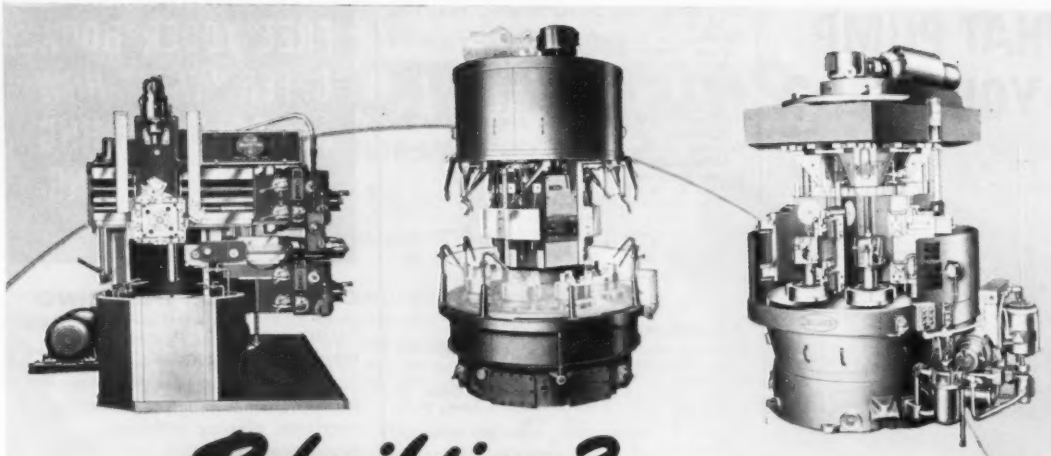
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

(Continued on page 296)

For more information fill in page number on Inquiry Card, on page 195



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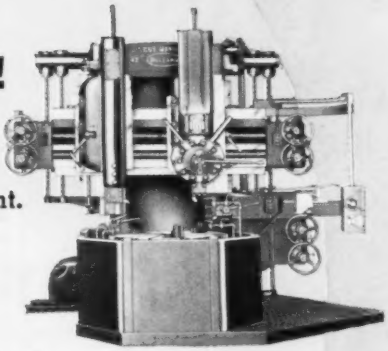

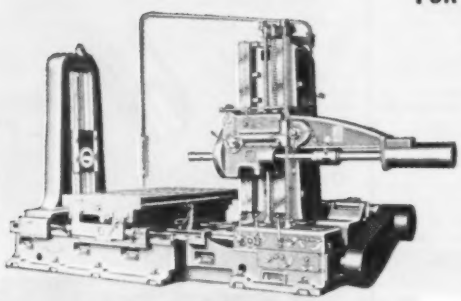

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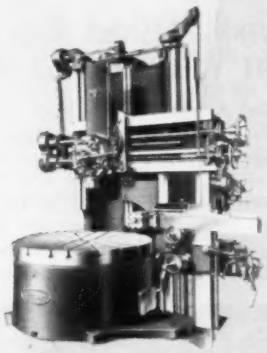

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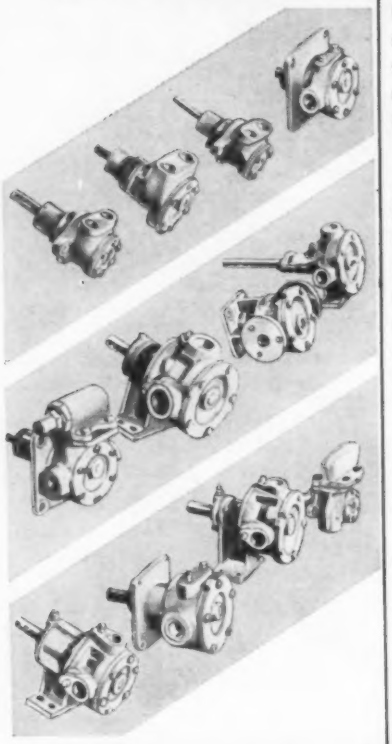

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Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecher Corp., 6784 W. National, Milwaukee 14, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Thread

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.

MOLDING MACHINES, Plastic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

MOTORS, Air

Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.

MOTORS, Electric

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Lincoln Electric Co., Cleveland 17, Ohio
Onsrud Machine Works, Inc., 7720 Lehigh Ave., Niles, Ill.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

Barnes, J. S., Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
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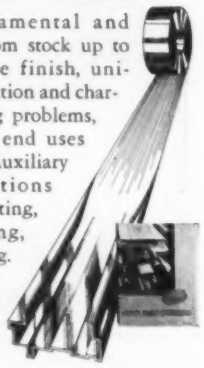

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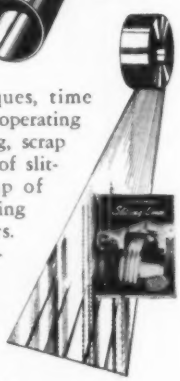

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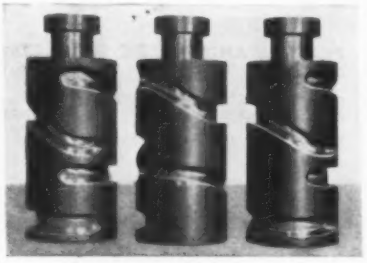

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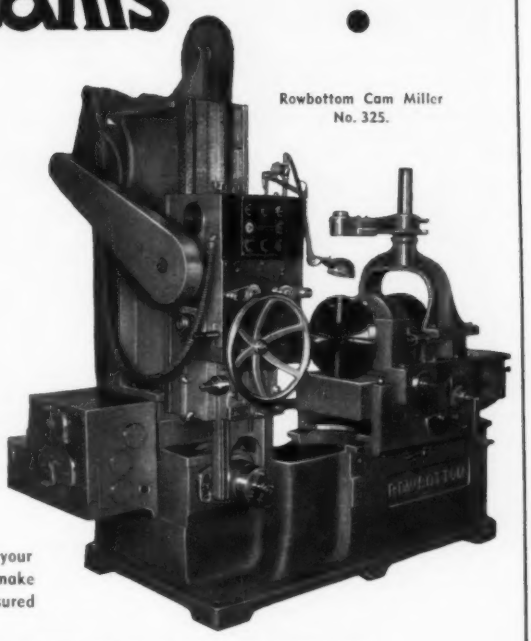

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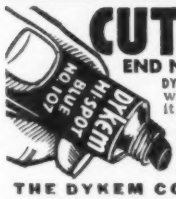

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co. (Tubular Prod. Div.), Beaver Falls, Penna.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld

Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

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Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS

Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

PRESS FEEDER, Automatic

Bliss Co., E. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

Alpha Press & Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
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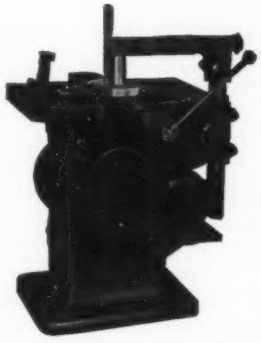

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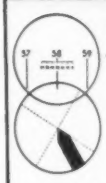

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TYPICAL INDUCTION HEATING APPLICATIONS

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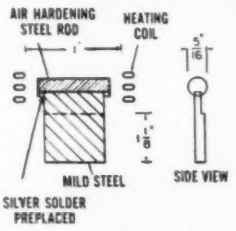

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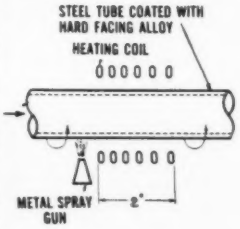
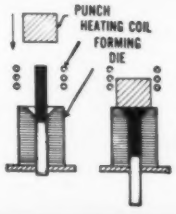


Corrosion or wear resistant metal coatings sprayed on metal surfaces can be improved by heating to achieve alloying by diffusion. The drawing shows a typical arrangement for processing steel tube sprayed with hard facing alloy. Long tubes may be progressively sprayed and heated.



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Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
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Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 55 N. 18th St., East Orange, N. J.
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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Walsh Press & Die Co., 4709 W. Kinzie St., Chicago 44, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

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Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
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Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)

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Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
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Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
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Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
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Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

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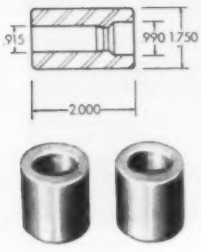

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Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Notching

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
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PRESSES, Punching, Piercing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Walsh Press & Die Co., 4709 W. Kinzie St., Chicago 44, Ill.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
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Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
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L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood, Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

American Engineering Co., Wheatsheaf Lane & Sepviva St., Philadelphia 37, Penna.
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford. Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Wilson, K. R., Inc., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

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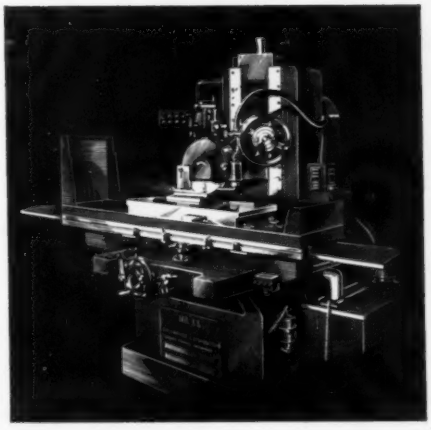

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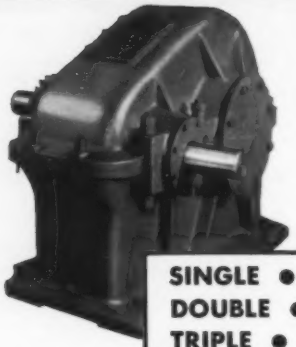

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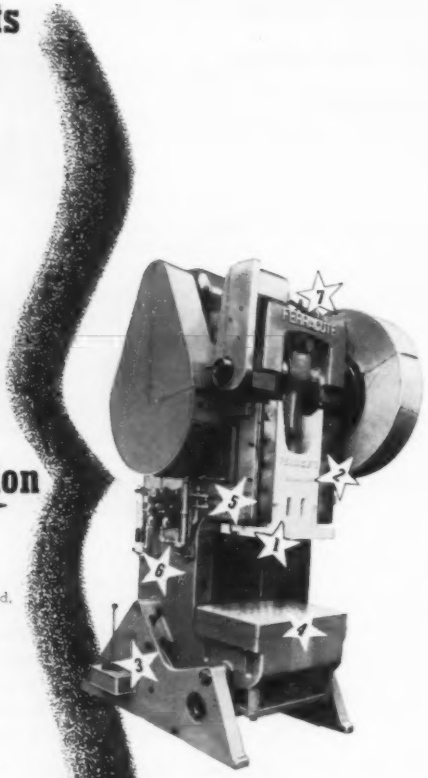

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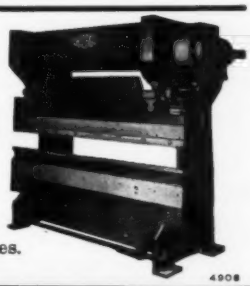

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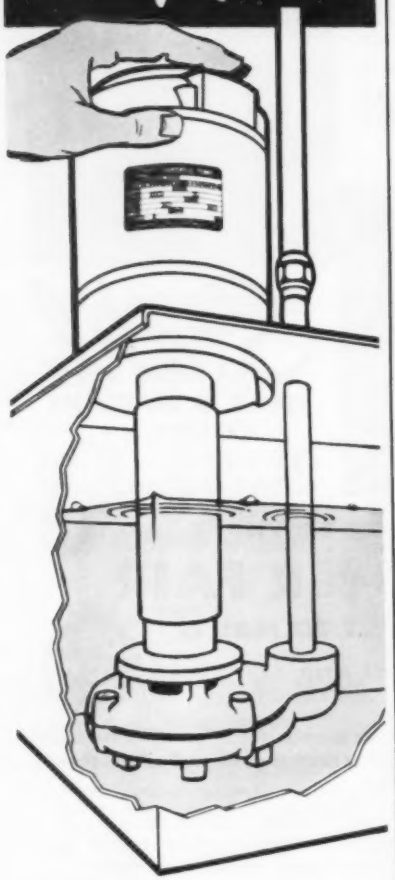

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Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD CUTTING MACHINES

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Davis & Thompson Co., 4460 W. 124th St. Milwaukee 10, Wis.
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Dayton 1, Ohio

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
National Machinery Co., Tiffin, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Dayton 1, Ohio
V & O Press Co., Hudson, New York

TOOL CONTROL BOARDS

Cross Co., 3250 Bellevue, Detroit 7, Mich.
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich.
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

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Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Haynes Stellite Co., 725 So. Lindsay St., Kokomo, Ind.
Vascoloy-Ramet Corp., Waukegan, Ill.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Vascoloy-Ramet Corp., Waukegan, Ill.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

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Wales-Strippit Co., Akron, N. Y.
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Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
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Babcock & Wilcox Co., Beaver Falls, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
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Vickers, Inc., Detroit 32, Mich.

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Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

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Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hts. Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc

Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Linde Co., New York 17, N. Y.

WELDING EQUIPMENT, Gas

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Linde Co., New York 17, N. Y.

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Federal Mch. & Welder Co., Warren, Ohio

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Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

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Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Nilson, A. H., Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

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No. 16CR16 Bryant, m.d., latest
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No. 24P—26" Bryant, m.d.
No. 24—21" Bryant, m.d.
No. 24-L—36" Bryant, m.d., late
No. 24-LW—36" Bryant, m.d., late
No. 44 Heald Facing Type Borematic, m.d.
No. 649—16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 70A Heald, m.d., latest, 1945
No. 72A3 Heald Full Universal, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Plain, m.d.
No. 72A5 Heald Plain, m.d.
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No. 74 Heald Long Base, 1943
No. 74 Heald Extended Bridge Type, m.d.
No. 75A Heald, m.d., latest
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Model DB-102 Excello Double End Boring Machine, m.d.

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No. 10 Brown & Sharpe, m.d.
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6x18" Cincinnati Model EA, m.d.
6x18" Cincinnati Model ER, Plain Hydraulic, m.d. Filmatic Spindle
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Plain Grinder, m.d.
10x18 Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x36" Landis Type CH Plain, m.d.
12x36" Landis Plain Self-Contained, m.d.
14x36" Landis Type C, 1944
16x72" centers Type C Norton Semi-Auto., Hydraulic
16x48" Landis Type D, 1945
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16x40x120" Cincinnati Plain Heavy Duty, 1953
16"x120" Landis Type B Plain H.P., Hydraulic, m.d., late
18x36" Landis Type C, m.d.
18x72" Norton Type C, mechanical, m.d.

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14"x30¼" centers Lodge & Shipley, m.d.
14"x31½" centers Lodge & Shipley, m.d.
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14"x33" centers Sidney, m.d.
14"x33¼" centers Lodge & Shipley, m.d.
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14"x36" centers LeBlend Geared Head, s.p.d.
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14"x36" centers Pratt & Whitney, cone
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14"x54" centers LeBlond Regal, m.d.
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16"x29½" centers Lodge & Shipley Selective Head, m.d.
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16"x30" centers Monarch, m.d., taper
16"x30" centers Monarch, Model CW, m.d.
16"x30" centers Hendey Geared Head, m.d.
16"x36" centers Lehmann, m.d.
16"x30" centers Reed Prentice, m.d.
16"x102" centers American High Duty, m.d.
16"x(actual swing 16¾")x52" centers Monarch, m.d., taper
16"x55½" centers Monarch, m.d.
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18"x39" centers Greaves-Klusman, m.d.
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18"x49" centers Lodge & Shipley, m.d.
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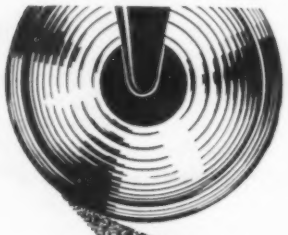

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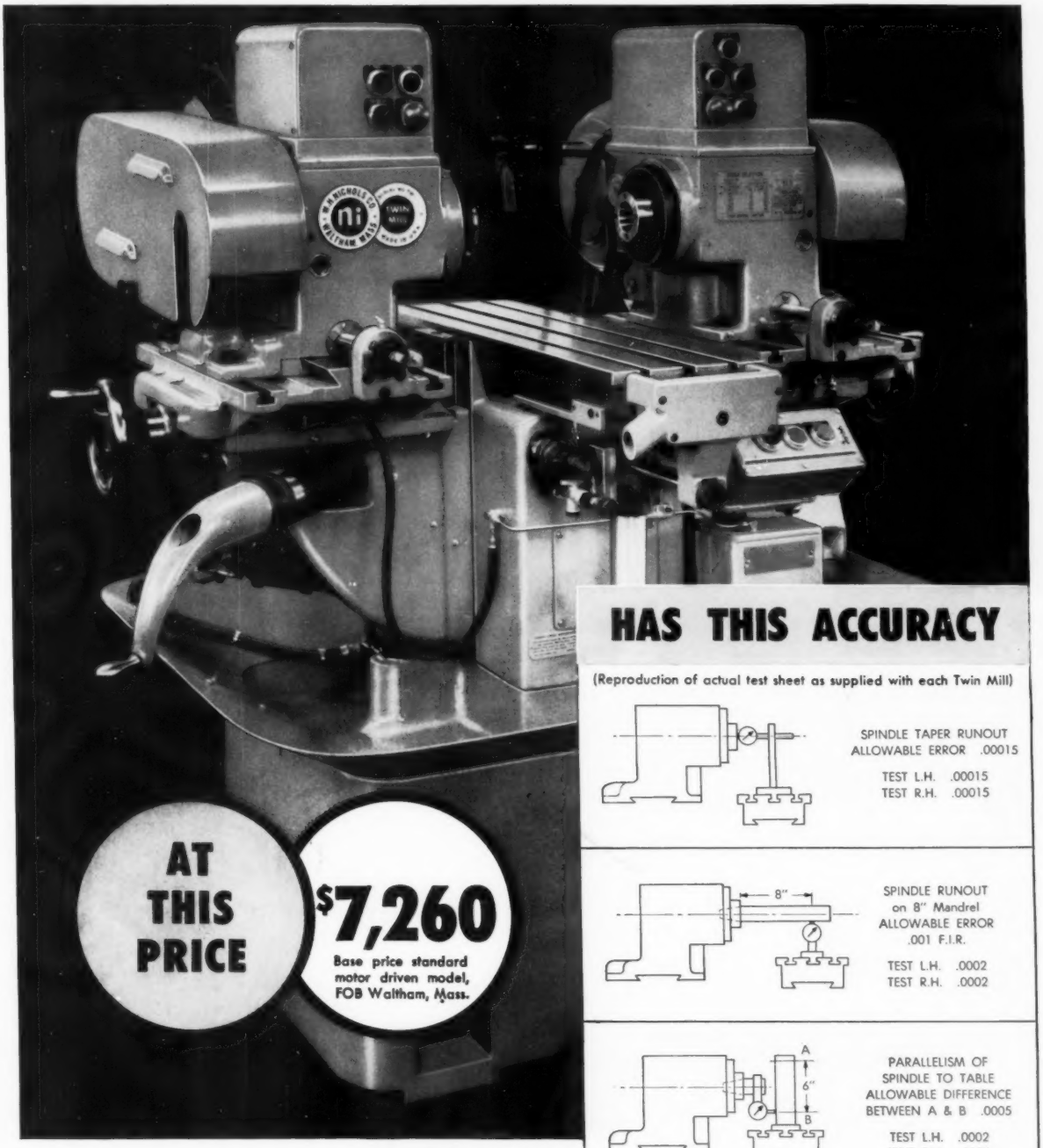

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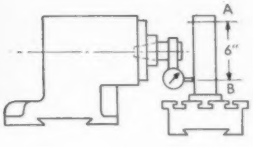

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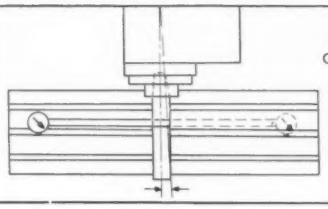

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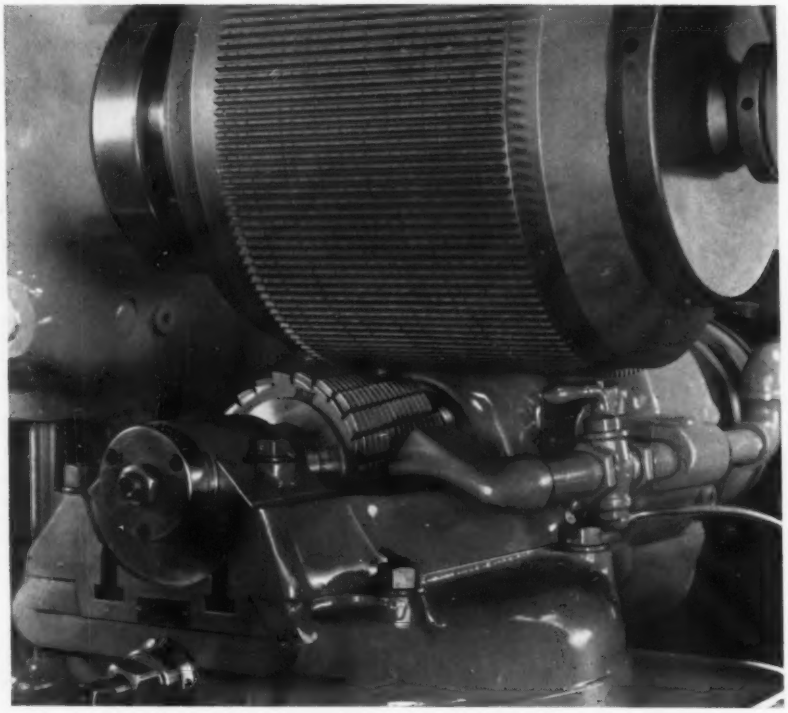

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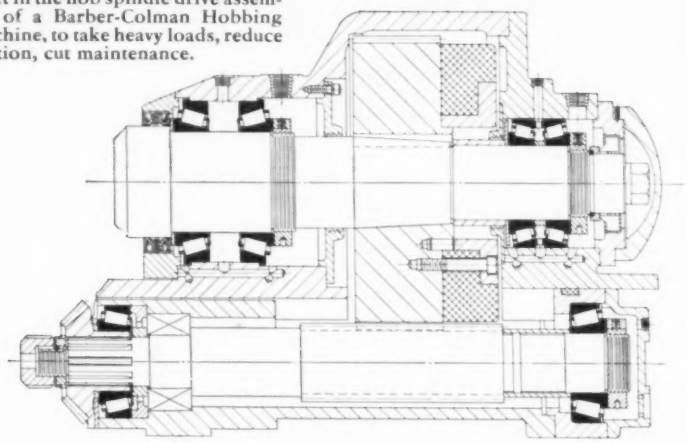

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